

Center for Economic Studies Research Report: 2020

Research and Methodology Directorate

Issued September 2021



MISSION

The Center for Economic Studies partners with stakeholders within and outside the U.S. Census Bureau to improve measures of the economy and people of the United States through research and the development of innovative data products.

HISTORY

The Center for Economic Studies (CES) was established in 1982 on a foundation laid by a generation of visionaries both inside and outside the Census Bureau. CES's early mission was to house data-bases on businesses, link them cross-sectionally and longitudinally, conduct economic research with them, and make them available to researchers.

Pioneering CES staff and visiting academic researchers began fulfilling that vision. Using these new data, their analyses sparked a revolution of empirical work in the economics of industrial organization.

Researcher access to these restricted-access data grew with the establishment of secure research data centers, the first of which was opened by CES in Boston in 1994. Today, there are such facilities located at dozens of universities and research organizations across the country.

In time, CES expanded its focus from data and research on businesses to also include workers and households. Today, CES staff carry out empirical research on a wide array of subjects, leading to important discoveries in economics and other social sciences, improvements in existing Census Bureau surveys and data products, enhanced research databases, and new statistics and information products for public use.

ACKNOWLEDGMENTS

Randy Becker coordinated the production of this report and wrote, compiled, or edited its various parts. **Nathan Goldschlag** and **Martha Stinson** authored Chapter 2. **Adela Luque**, **Michaela Dillon**, **James Noon**, and **Kevin Rinz** authored Chapter 3. Other CES staff contributed updates used throughout.

Faye E. Brock and **Linda Chen** provided publication management, graphic design and composition, and editorial review for the print and electronic media under the direction of **Christine Geter**, acting chief of the Graphic and Editorial Services Branch, Public Information Office.

DISCLAIMER

Research summaries in this report have not undergone the review accorded Census Bureau publications, and no endorsement should be inferred. Any opinions and conclusions expressed herein are those of the author(s) and do not necessarily represent the views of the Census Bureau or other organizations. All results have been reviewed to ensure that no confidential information is disclosed.

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Research and Methodology Directorate



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A MESSAGE FROM THE CHIEF ECONOMIST

These Center for Economic Studies (CES) annual reports provide an opportunity to celebrate our accomplishments over the last year, offer in-depth looks at our major initiatives, and highlight our vision for future research and development activities. However, 2020 will be forever most remembered for the impacts that the COVID-19 pandemic had on the lives of all Americans.



How and where CES did its work changed in mid-March, as it did for so many, but the focus of some of our work also shifted in 2020—while continuing to carry out our previously planned research and development activities. Chapter 1 opens with a discussion of CES staff providing emergent technical support to the 2020 Census; developing content and analytic tools for the Small Business Pulse Survey, which was quickly established to measure the pandemic's impact; and helping to launch supplemental weekly Business Formation Statistics to provide timely, high-frequency data at an especially critical time.

Chapters 2 and 3 focus on two multiyear efforts that CES staff brought to successful completions in 2020. One way to categorize business activity is by employer and nonemployer status. CES conducts research and development activities on both types of businesses, as is evidenced in the work described in Chapters 2 (employers) and 3 (nonemployers).

Chapter 2 describes CES staff intensive efforts that led to improvements in two of CES' flagship data products: the Longitudinal Business Database (LBD) and Business Dynamics Statistics (BDS). The LBD is a confidential database of private, nonfarm employer businesses developed by CES economists more than 20 years ago. Since then, it has become one of the most requested databases by qualified researchers on approved projects in the Federal Statistical Research Data Centers. The LBD is also the data infrastructure that supports the BDS public-use data product, which provides annual measures of job creation and job destruction, firm startups and shutdowns, and establishment entry and exit. These statistics are available for the entire economy and for subsets of businesses classified by size, age, industry, and/or geography. The BDS are continually cited in the press, by policymakers, and are used by academics to help understand the U.S. economy.

Chapter 3 provides an introduction to the new annual data product Nonemployer Statistics by Demographics (NES-D). As its name suggests, the NES-D focuses on nonemployers, which are businesses with no paid employees. Nonemployers account for a large share of U.S. businesses but are relatively small, so they account for only about three percent of total revenue. The NES-D produces annual statistics on the number of nonemployer businesses and their receipts by owner sex, ethnicity, race, and veteran status, with additional detail available by industry, geography, receipt-size class, and legal form of organization. Some additional demographic characteristics on owners are also available, including age, foreign-born status, and citizenship

(Continued)

A MESSAGE FROM THE CHIEF ECONOMIST—Con.

status. The authors of Chapter 3 provide details about the motivation for the development of the NES-D, a discussion of some of the challenges that the team faced, and a sample of some interesting statistics from the series.

Looking towards the future, CES researchers are working on projects that cover many areas of the U.S. economy and population. As some examples, CES staff have created a community of practice spanning all areas of the U.S. Census Bureau concerning research related to the environment, natural disasters, and energy. The aptly named Environment, Natural disasters, and Energy Research Group (ENERG) serves as a coordination and collaboration body for climate- and environment-related research across the Census Bureau. CES staff are also focusing attention on the measurement of business deaths, which became especially important during the pandemic. Finally, CES staff are working on greater integration of business and demographic data over a variety of areas.

Thank you to everyone who contributed to our annual report. Randy Becker compiled and edited all of the material. Editorial review was performed by Faye Brock, and design services and cover art production by Linda Chen, both of the Public Information Office. Other contributors are acknowledged on the inside cover.

A handwritten signature in black ink that reads "Lucia S. Foster". The script is fluid and cursive, with the first letters of each name being capitalized and prominent.

Lucia S. Foster, Ph.D.
Chief Economist and
Chief of the Center for Economic Studies

Chapter 1. 2020 News

MEETING CHALLENGES AND PRODUCING CRITICAL INFORMATION

Pivoting to remote work posed some challenges for Center for Economic Studies (CES) staff, but pulling together, we met these challenges. In addition to providing research support for 2020 Census operations, CES staff lent their expertise toward two U.S. Census Bureau products supplying critical information during the COVID-19 pandemic, while our regular research and development activities continued apace.

Throughout 2020, CES staff contributed timely expertise to several 2020 Census efforts in response to challenges including the pandemic. Our staff provided analyses and support in several areas, including group quarters enumeration, self-response quality assurance, and measuring citizenship in the population.

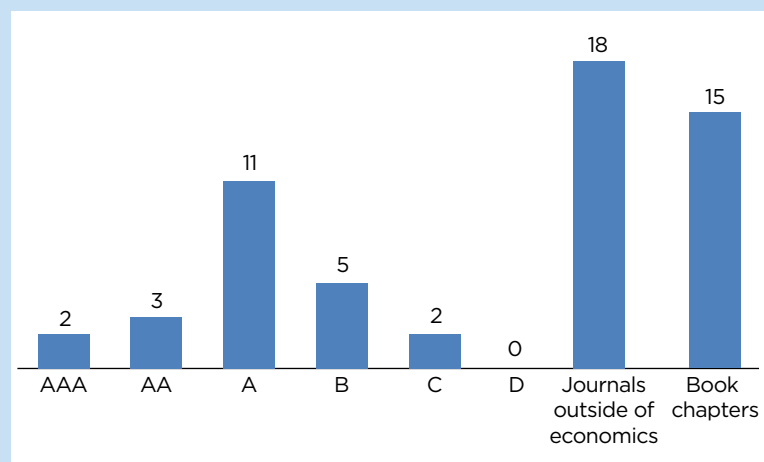
In response to the COVID-19 pandemic, the Census Bureau introduced a number of new data products including the Household Pulse Survey, the Small Business Pulse Survey (SBPS), Community Resilience Estimates, and weekly Business Formation Statistics (BFS). CES staff contributed to the SBPS in a number of capacities: developing content, creating indices, providing weekly analysis, and documenting the survey and results via CES working papers.

In response to the need for more timely data, CES researchers worked with the Economic Directorate to produce a weekly version of the BFS—an experimental product developed in CES and released on a quarterly basis beginning in 2018. The SBPS and the weekly BFS both started publishing results in spring of 2020 and continue to provide critical information.

While it's hard to recreate a collegial research office virtually, our talented staff (Appendix 6) nonetheless had a productive year. CES research staff released 28 new papers in the CES Working Paper Series (Appendix 3 for abstracts) and had another 56 papers

published (or forthcoming) as journal articles or book chapters (Appendix 2). Some recently published journal articles are highlighted in the “Notable 2020 Publications by Center for Economic Studies Staff” text box. The “Publications by Center for Economic Studies Staff by Journal Rank: 2020 and Forthcoming” figure shows that CES staff research is being published in many of the top peer-reviewed journals in economics including the *Quarterly Journal of Economics*, *Journal of Political Economy*, *Journal of Public Economics*, *European Economic Review*, and *Journal of Labor Economics*.

Figure 1-1.
**Publications by Center for Economic Studies Staff by
Journal Rank: 2020 and Forthcoming**



Note: Ranking of journals in economics is taken from Combes and Linnemer (2010), where categories (ranks) are: AAA (1–5), AA (6–20), A (21–102), B (103–258), C (259–562), and D (563–1,202).
Source: U.S. Census Bureau.

NOTABLE 2020 PUBLICATIONS BY CENTER FOR ECONOMIC STUDIES STAFF

“Race and Economic Opportunity in the United States: An Intergenerational Perspective”

Raj Chetty, Nathaniel Hendren, **Maggie R. Jones**, and **Sonya R. Porter**

Quarterly Journal of Economics

Volume 135, Issue 2, May 2020, pp. 711–783

We study the sources of racial disparities in income using anonymized longitudinal data covering nearly the entire U.S. population from 1989 to 2015. We document three results. First, Black Americans and American Indians have much lower rates of upward mobility and higher rates of downward mobility than Whites, leading to persistent disparities across generations. Conditional on parent income, the Black-White income gap is driven by differences in wages and employment rates between Black and White men; there are no such differences between Black and White women. Hispanic Americans have rates of intergenerational mobility more similar to Whites than Blacks, leading the Hispanic-White income gap to shrink across generations. Second, differences in parental marital status, education, and wealth explain little of the

Black-White income gap conditional on parent income. Third, the Black-White gap persists even among boys who grow up in the same neighborhood. Controlling for parental income, Black boys have lower incomes in adulthood than White boys in 99 percent of census tracts. The few areas with small Black-White gaps tend to be low-poverty neighborhoods with low levels of racial bias among Whites and high rates of father presence among Blacks. Black males who move to such neighborhoods earlier in childhood have significantly better outcomes. However, less than 5 percent of Black children grow up in such areas. Our findings suggest that reducing the Black-White income gap will require efforts whose impacts cross neighborhood and class lines and increase upward mobility specifically for Black men.

“Business Dynamics Statistics of High-Tech Industries”

Nathan Goldschlag and Javier Miranda

Journal of Economics & Management Strategy

Volume 29, Issue 1, Spring 2020, pp. 3–30

Modern market economies are characterized by the reallocation of resources from less productive, less valuable activities to more productive, more valuable ones. Businesses in the high-tech sector play a particularly important role in this reallocation by introducing new products and services that impact the entire economy. In this paper, we describe an extension to the U.S. Census Bureau’s Business

Dynamics Statistics, which tracks job creation, job destruction, startups, and exits by firm and establishment characteristics including sector, firm age, and firm size in the high-tech sector. We preview the resulting statistics, showing the structural shifts in the high-tech sector over the past 30 years including the surge of entry and young firm activity in the 1990s that reversed abruptly in the early-2000s.

THE CENTER FOR ECONOMIC STUDIES DISSERTATION MENTORSHIP PROGRAM

Many graduate students use restricted-use U.S. Census Bureau microdata in the federal statistical research data centers for their Ph.D. dissertation research, and many of these doctoral candidates are eligible to apply to the Center for Economic Studies (CES) Dissertation Mentorship Program. Program participants are assigned one or more CES researchers as mentors, who advise students

on the use of Census Bureau microdata. Students are also given the opportunity to visit CES to meet with our research staff and present research in progress. This year, CES accepted six new participants into the program and, at the close of 2020, mentored 52 students from 25 different universities and a variety of different disciplines since the program began in 2008.

More information is available about our researchers and our research, including access to papers in our working paper series (which also continues to include working papers by researchers active in the federal statistical research data centers), on our Web site <www.census.gov/programs-surveys/ces.html>. Our Web site also includes links to our public-use data products and our various analysis and visualization tools which are discussed next.

RELEASES OF PUBLIC-USE DATA

CES continued to maintain and update its public-use data products in 2020, including *Business Dynamics Statistics*, *Business Formation Statistics*, *Dispersion Statistics on Productivity*, *Quarterly Workforce Indicators*, *LEHD Origin-Destination Employment Statistics*, *OnTheMap*, *OnTheMap for Emergency Management*, *Job-to-Job Flows*, *Post-Secondary Employment Outcomes*, and the *Opportunity Atlas*. In addition, 2020 saw the launch of a new,

experimental statistical product: *Veteran Employment Outcomes*.

In September 2020, the U.S. Census Bureau released the 2018 ***Business Dynamics Statistics*** (BDS), which provides annual statistics from 1978 to 2018 on establishment openings and closings, firm startups and shutdowns, employment, job creation, and job destruction by firm (or establishment) size, age, industry, state, metropolitan area, and county.

With this release, the *BDS* has been fully redesigned, with improvements and enhancements on several dimensions. This includes a substantial expansion of the set of characteristics over which statistics are released. The most notable are statistics using a consistent NAICS industry classification for the entire time series, at the sector, 3-digit, and 4-digit NAICS levels. In addition, available geography now also includes metropolitan statistical area (MSA) and county. Several new multiway interactions permit analyses at levels of detail not previously possible, including county by firm size

and firm age as well as MSA by NAICS sector by firm size and firm age groups. These more disaggregated *BDS* statistics are possible in part because of the use of noise infusion as the disclosure avoidance methodology. The redesigned *BDS* also reflects improvements in source data (especially in early years), an integration with the Statistics of U.S. Businesses data program, greater alignment with County Business Patterns data, improvements to the linking methodology, and standardization of the production processing.

More information about the *BDS* is available at <www.census.gov/programs-surveys/bds.html>. Chapter 2 of this annual report provides a further introduction to the *BDS* and its recent redesign.

In 2018, the Census Bureau launched the ***Business Formation Statistics*** (BFS)—an experimental public-use data series on business startups. In particular, the *BFS* provides timely, quarterly measures of new business applications and business formations. Business

applications are indicated by applications for an Employer Identification Number (EIN), while business formations (actual and projected) originating from such business applications are based on the first recorded payroll tax liability for an EIN. Delays in business formation are measured by the average duration between business application and business formation. All *BFS* series are available for the United States, the 50 states, and Washington, DC, beginning with the third quarter of 2004.

In 2020, a number of changes to the *BFS* were introduced. Research into producing higher frequency statistics were well underway when the pandemic struck. In April, the Census Bureau quickly reacted and began releasing state-level weekly *BFS* on business applications, in order to provide data users with more timely data on the rapidly changing business environment. To satisfy an interest in industry-specific weekly data, a one-time release of business applications data by industry was released for all of 2019 through week 40 of 2020. In November, the first publication of annual business applications *by county* was released for 2005–2019 and will be updated and released annually.

Beginning in 2021, the quarterly series will be replaced by monthly series, retroactive to July 2004, which will be released on a monthly schedule going forward. *BFS* data will also be available by NAICS sector.

Further details on the *BFS* and access to the latest data are available at <www.census.gov/econ/bfs/>. Chapter 3 of our 2018 annual report also offers an introduction to the *BFS*.

The *BFS* is a product of CES, developed in research collaboration with economists from the Board of Governors of the Federal Reserve System, Federal Reserve Bank of Atlanta, University of Maryland, and University of Notre Dame.

In 2019, the Census Bureau and the Bureau of Labor Statistics (BLS) launched ***Dispersion Statistics on Productivity*** (*DiSP*), an experimental data series that sheds new light on the U.S. manufacturing sector. The *DiSP* includes annual measures of within-industry dispersion in productivity (i.e., output per hour and multifactor productivity) for each 4-digit NAICS manufacturing industry. The measures of dispersion include standard deviation, interquartile range (75–25), and interdecile range (90–10). With an update in September, the *DiSP* now covers 1997 through 2016. More details on the *DiSP* and access to the data are available at <www.census.gov/disp/>.

The Quarterly Workforce Indicators (QWI) is a set of economic indicators—including employment, job creation, earnings, worker turnover, and hires/separations—available by different levels of geography, industry, business characteristics (firm age and size), and worker demographics (age, sex, educational

attainment, race, and ethnicity). In 2015, the Census Bureau first introduced the *National Quarterly Workforce Indicators*, which provide a consistent reference point for users of the state-level QWI. These data are available via the *LED Extraction Tool* at <<https://ledextract.ces.census.gov>>.

These data are also available through *QWI Explorer*, a Web-based analysis tool that enables comprehensive access to the full depth and breadth of the QWI dataset. Through an easy-to-use dashboard interface, users can construct tables and charts to compare, rank, and aggregate indicators across time, geography, and/or firm and worker characteristics. Users can download their analyses to an Excel spreadsheet, a PNG/SVG chart image, or a PDF report, or they can share data tables and visualizations via URLs and through social media. Access to *QWI Explorer* is available at <<https://qwexplorer.ces.census.gov>>.

This year's releases incorporated the latest available data from states and updated the base geography to TIGER 2019.

CES staff continue to maintain and improve the ***LEHD Origin-Destination Employment Statistics*** (LODES) and the ***OnTheMap*** application. *LODES* is a partially synthetic dataset that describes the geographic patterns of jobs by their employment locations and residential locations and the connections between the two locations, and *OnTheMap* is the

award-winning online mapping and reporting application that utilizes *LODES* data to show where people work and where workers live. The easy-to-use interface allows the creation, viewing, printing, and downloading of workforce-related maps, profiles, and underlying data. An interactive map viewer displays workplace and residential distributions by user-defined geographies at census block-level detail. The application also provides companion reports on worker characteristics and firm characteristics, employment and residential area comparisons, worker flows, and commuting patterns. In *OnTheMap*, statistics can be generated for specific segments of the workforce, including age, earnings, sex, race, ethnicity, educational attainment, or industry groupings. One can also find firm age and firm size, allowing analysis of the impacts of young/old firms or small/large firms in relation to commuting patterns and worker characteristics. Both *LODES* and *OnTheMap* can be used to answer a variety of questions on the spatial, economic, and demographic aspects of workplaces and home-to-work flows.

In December, version 6.8 of *OnTheMap* was released, adding an additional year of *LODES* data, extending availability from 2002 through 2018, and back-filling data on federal workers for 2016 and 2017. This release also updates the base geography to TIGER 2019.

OnTheMap can be accessed at <<https://onthemap.ces.census.gov>>, and *LODES* data can

be directly downloaded at <<https://lehd.ces.census.gov/data/#lodes>>.

This year, two new versions of ***OnTheMap for Emergency Management*** (OTMEM) were released. First introduced in 2010, *OTMEM* is an online data tool that provides unique, real-time information on the population and workforce for areas affected by hurricanes, floods, wildfires, and winter storms, and for federal disaster declaration areas. Through an intuitive interface, users can easily view the location and extent of current and forecasted emergency events on a map and retrieve detailed reports containing population and labor market characteristics

for these areas. These reports provide the number of affected residents by age, race, ethnicity, sex, and housing characteristics. The reports also provide the number and location of jobs by industry, worker age, earnings, and other worker characteristics. To provide users with the latest information on rapidly changing events, *OTMEM* automatically incorporates real-time data updates from the National Weather Service, U.S. Department of Interior and U.S. Department of Agriculture, and the Federal Emergency Management Agency. Chapter 2 of our 2013 annual report offers a more detailed overview of *OTMEM*.

LONGITUDINAL EMPLOYER-HOUSEHOLD DYNAMICS TURNS 20

Twenty years ago, the U.S. Census Bureau set out to create a secure database of all jobs in the United States and to provide new data and tools to policymakers to help them track the vitality of the U.S. workforce.

What began as a pilot—to combine the wage records from one state, Maryland, with data on individuals and businesses already collected by the Census Bureau—became Longitudinal Employer-Household Dynamics (LEHD), a source of a number of innovative data products, including *Quarterly Workforce Indicators*, *OnTheMap*, *Job-to-Job Flows*, and *Post-Secondary Employment Outcomes*. All of these data have been made easy-to-access using interactive tools that require little training.

Among the enduring features of LEHD data products are that they impose no additional data collection burden on workers or their employers and are created at relatively minimal expense. The Center for Economic Studies continues to explore new ways to use this same data infrastructure to create data and tools that will shed even greater light on the U.S. labor market.

In February, version 4.4.3 was released, which updated the American Community Survey data to the 2014–2018 5-year estimates and updated the underlying *LODES* data to 2017. In August, version 4.4.4 updated the map display to show separately the COVID-19 Emergency and Disaster Declaration areas that have been declared. *OTMEM* can be accessed at <<https://onthemap.ces.census.gov/em/>>.

Both *OnTheMap* and *OTMEM* are supported by the state partners under the Local Employment Dynamics (LED) partnership with the Census Bureau, as well as the Employment and Training Administration of the U.S. Department of Labor.

CES staff continue to update **Job-to-Job Flows** (J2J), a set of statistics on the movements of workers between jobs including information on the job-to-job transition rate, hires and separations from and to non-employment, earnings changes due to job change, and characteristics of origin and destination jobs for workers changing jobs. These statistics are available at the national, state, and metropolitan area levels and by (origin and destination) NAICS sector, firm age and size, and worker demographic characteristics including sex, age, education, race, and ethnicity.

In June, four new measures of average earnings were added to the core J2J tables, namely average earnings prior to (following) stable job-to-job separations (hires) for both continuous employment and brief

nonemployment. In addition, many additional series now have seasonally adjusted equivalents.

These J2J data files and associated documentation are available for download at <<https://lehd.ces.census.gov/data/#j2j>>.

First released in 2017, *Job-to-Job Flows Explorer* is an interactive, Web-based analysis and visualization tool that allows users to construct tables, maps, and charts to compare, aggregate, and analyze J2J statistics by worker and firm characteristics. In September, version 1.01 was released, providing access to the most recent J2J data, introducing new earnings indicators for comparisons, and fixing various bugs.

Access to *J2J Explorer* is available at <<https://j2jexplorer.ces.census.gov>>. Documentation is available at <https://lehd.ces.census.gov/applications/help/j2j_explorer.html>.

This year also saw the further expansion and development of the experimental **Post-Secondary Employment Outcomes** (PSEO) statistics and visualization tool. First introduced in 2018, *PSEO* provides earnings and employment outcomes of post-secondary graduates by institution, degree field, and degree level for 1, 5, and 10 years after graduation. Tabulations also include the destination industry and geography of employed graduates. This year, numerous institutions in New York, Pennsylvania, and Texas were added. Tabulations now also use 2020 Classification of Instructional

Program (CIP) codes, and new earnings aggregations at the 2-digit CIP level are now included. The *PSEO Explorer* provides users with an easy way to visualize graduates' earnings outcomes and employment flows. For more information about *PSEO* and examples of its use, refer to Chapter 3 of our 2019 annual report.

PSEO data and documentation are available at <https://lehd.ces.census.gov/data/pseo_experimental.html>. Access to *PSEO Explorer* is available at <https://lehd.ces.census.gov/data/pseo_explorer.html>.

In May, **Veteran Employment Outcomes** (VEO), our latest experimental data product, was launched. *VEO* provides earnings and employment outcomes in the civilian labor market for U.S. Army veterans by military occupation, rank, years of service, demographic characteristics (age, sex, race, ethnicity, education), industry, and geography of employment for 1, 5, and 10 years after they completed their initial term of active-duty service. *VEO* statistics can also be accessed using *VEO Explorer*, an easy-to-use, interactive, visualization tool that allows comparisons of veterans' outcomes with line and bar charts. More information about *VEO* and examples of its use are available in Chapter 3 of our 2019 annual report.

VEO data and documentation are available at <https://lehd.ces.census.gov/data/veo_experimental.html>. Access to *VEO Explorer* is available at <<https://lehd.ces.census.gov/applications/veo>>.

A list of partners who make our *QWI*, *LODES*, *OnTheMap*, *OTMEM*, *J2J*, *PSEO*, and *VEO* products possible is in Appendix 5.

In 2018, in collaboration with researchers at Harvard University and Brown University, the Census Bureau launched the **Opportunity Atlas**, a new interactive tool providing access to highly localized data on social mobility. Using anonymized data covering nearly the entire U.S. population, the *Opportunity Atlas* contains tract-level information on children's outcomes in adulthood including income and incarceration rates by parental income, race, and gender. Visitors to <<https://opportunityatlas.org>> can explore the data through the online visualization tool, overlay their own data of interest, and download the resulting measures into a dataset for their own analyses. Chapter 2 of our 2018 annual report contains a more in-depth discussion of the *Opportunity Atlas* and its potential for policymakers and researchers interested in inter-generational mobility.

RESEARCH WORKSHOPS

The workshops that CES had planned for 2020 were all cancelled or postponed, including what would have been the tenth annual BLS-Census Research Workshop and the twenty-first LED Partnership Workshop. Workshops will return in an online-only format in 2021, with the second IRS-Census Income Measurement Workshop in March, the first Census Bureau Mortality Studies Workshop in March, and the LED Workshop in April.

THE LOCAL EMPLOYMENT DYNAMICS WEBINAR SERIES

The U.S. Census Bureau and the Local Employment Dynamics (LED) Partnership, in collaboration with the Council for Community and Economic Research, hosts an ongoing Webinar series focusing on uses of Longitudinal Employer-Household Dynamics (LEHD) data. In 2020, the following Webinars were held:

- Using National Jobs Data to Measure Graduate Impact (Andrew Foote, CES).
- Combining Census Data with OpenStreetMap Data to Develop Highway Access Measures (Colby Brown, Manhan Group).
- Statistics of Army Veterans Transitioning into the Civilian Labor Market (Erika McEntarfer, CES).
- COVID-19 Demographic and Economic Resources Using Census Data (Andrew Hait and Earlene Dowell, Census Bureau).
- Analyzing Job-to-Job Flows in the Houston Metropolitan Area Using LEHD J2J Data (Pramod Sambidi, Houston-Galveston Area Council).
- Providing Perspective During COVID-19 Using Census Data (Cameron Macht, Minnesota Department of Employment and Economic Development).
- Connecticut's Manufacturing Workers Age Profile and Implications for Earnings (Patrick Flaherty, Connecticut Department of Labor).
- A Preliminary Investigation Into the Metro Area Job-to-Job Flows and Earnings Data in the Manufacturing Sector (Dylan Schafer, Michigan Bureau of Labor Market Information).
- Job-to-Job Flows and the Consequences of Job Separations (Matthew Staiger, CES).

Recordings of these and earlier Webinars are available at <<https://lehd.ces.census.gov/learning/#webinars>>.



The Citizenship Data Quality and Legal Support Team provided urgent technical support for the 2020 Census.

CES STAFF RECEIVE RECOGNITION

In November, Emin Dinlersoz and eight other team members were presented the Department of Commerce's Silver Medal Award for their successful development and launch of the Census Bureau's Business Formation Statistics, which offers near real-time measures of entrepreneurial activity at the state and national levels. (Chapter 3 of our 2018 annual report contains

an overview of the *BFS*.) The Silver Medal, the second-highest honorary award given by the department, is granted by the Secretary of Commerce for exceptional performance characterized by noteworthy or superlative contributions that have a direct and lasting impact within the department.

In a February ceremony, the Census Bureau recognized the achievements of nine CES staff members with the Bronze Medal

Award for Superior Federal Service. Established in 1965, the Bronze Medal is the highest honorary recognition given by the Census Bureau.

At that ceremony, Maggie Jones and Sonya Porter were recognized for their work with their academic partners in creating the *Opportunity Atlas*, an innovative data tool that maps inter-generational mobility at a highly localized level. Chapter 2 of our 2018 annual report provides an overview of *Opportunity Atlas*.

In the same ceremony, David Brown, Suzanne Dorinski, Lawrence Warren, Moises Yi, and others were awarded a Bronze Medal for their 18 months of work on the citizenship data quality and legal support team. The request to add a citizenship question to the 2020 Census, the Secretary of Commerce's instruction to do so in combination with administrative records, and lawsuits seeking to enjoin the Census Bureau from asking the question, required the urgent technical research and support that this team provided.



The Global Market Finder Team developed an interactive tool for companies to identify promising export opportunities.

C.J. Krizan and the four other members of the Global Market Finder Team were recognized for their efforts to develop an interactive tool for companies to identify the most promising overseas export markets for their product, utilizing the most up-to-date international trade statistics.

Cheryl Grim and Danielle Sandler, along with other team members, received a Bronze Medal for successfully migrating research by Census Bureau staff and external researchers in the federal statistical research data centers to the Integrated Research Environment (IRE), allowing researchers access to a single repository for data sharing and collaboration.

We applaud all these award recipients for their dedication and effort.



The successful migration of projects to the IRE benefited one thousand researchers internal and external to the Census Bureau.

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Chapter 2.

Reintroducing the Longitudinal Business Database (LBD) and Business Dynamics Statistics (BDS)

Nathan Goldschlag and Martha Stinson, Center for Economic Studies

Introduction

In this chapter, we describe recent improvements to the U.S. Census Bureau's Longitudinal Business Database (LBD) and Business Dynamics Statistics (BDS) products. The LBD is a confidential historical listing of private, nonfarm business establishments with employees that operated in the United States starting in 1976. First developed by the Center for Economic Studies (CES) economists in the late 1990s (Jarmin and Miranda, 2002), this database links establishment records over time, enabling researchers to calculate year-to-year employment changes and observe the birth, death, expansion, and contraction of firms and their establishments.¹ The BDS is a public-use data product tabulated from the LBD. First published in 2009, the BDS provides measures of job creation, job destruction, and firm and establishment entry and exit, as well as measures of total employment and establishment counts. These statistics are created for the entire economy and for subsets of businesses classified by size, age, industry, geography, or combinations of these characteristics. Over time, the LBD and the BDS have become important tools for measuring

the composition of economic activity across geographic locations, industries, and firm and establishment characteristics. In particular, researchers have relied on the BDS to provide information about the contribution of entrepreneurship to job creation, long-run trends in start-up activity, and the changing size and age composition of firms in the economy.

To ensure the continuation and quality of these data products, CES staff led a multiyear effort to develop a formal production system for the LBD and BDS that was fully documented, efficient, and replicable. Working together with analysts and programmers in the Census Bureau's Economic Directorate, CES staff developed a system that is flexible enough to process annual data in many different historical formats, fast enough to create the 43-year time series (1976–2018) in one-half the time previously required, and capable of producing more detailed BDS statistics at the county-level and within 4-digit NAICS industry categories. The team reached a major milestone in September 2020, when the new production system was used for the first time to produce the 2018 vintage of the LBD and publish the 2018 BDS. Users can explore these new BDS statistics through BDS Explorer, a data

visualization tool available at www.census.gov/data/data-tools/bds-explorer.html, and researchers with approved projects are now able to use the new restricted-use LBD microdata files in the federal statistical research data centers (FSRDCs).

We begin this chapter with a review of the contents and uses of the LBD and BDS and describe patterns in start-up activity using the BDS tabulations. We then give a brief overview of the reengineered production process. Finally, we conclude with ideas for future development of the LBD and BDS.

Contents and Uses of the LBD and BDS

The LBD is created using the Business Register (BR), the Census Bureau's sampling frame for economic surveys and censuses, which contains the universe of nonfarm *employer* business establishments. (Data on *nonemployer* businesses are the subject of Chapter 3 of this annual report.) The main contribution of the LBD is to link annual snap shots of the BR over time to measure changes in business activity. The basic building block of the BR, and in turn the LBD, is the establishment, which represents a physical place of business. Each establishment has

¹ For more history of the development of the LBD and BDS, refer to Chow et al. (2021).

geographic identifiers (street address, county, metropolitan statistical area [MSA], state), an industry code, payroll, and employment. Using the longitudinal linking of the LBD, we also track establishments over time and calculate the age of each establishment in every year of operation. In addition to establishment characteristics, the LBD also contains information about firms. A firm in the LBD is an entity that holds one or more establishments in common ownership. The firm-establishment link allows characteristics of firms, such as size and age, to be assigned to establishments.²

The LBD is one of the most frequently requested data-sets within the FSRDC system. Researchers have used the LBD to study many different topics including entrepreneurship and innovation, the impacts of trade, firm financing, and policies such as the minimum wage, to name a few. The LBD is also key in linking establishments longitudinally and grouping establishments by firm. For a complete codebook and instructions on how to link the LBD to other data sources, refer to Section 3 and Appendix A of Chow et al. (2021).

² Firm size of an establishment is calculated as the average of the sum of employment of all establishments owned by the establishment's associated firm in year t and the sum of employment of all establishments owned by the establishment's associated firm in year $t-1$. An establishment may change ownership between year $t-1$ and t and, therefore, its firm size may change as well. Firm age is calculated as the age of the oldest establishment in the firm's first year with positive employment after which the firm age increments each year. Firms born at age zero are start-ups or new firms. Firms born at older ages are either reactivations or reorganizations of existing establishments.

The BDS tables, tabulated from the LBD, contain stock and flow measures of establishments and employment. Establishment flows include establishment entry and exit, and employment flows include job creation and job destruction. Establishments enter employment-active status when they change from having no workers to having paid employees. Exit is the opposite—an establishment exits when it sheds all its workers from one year to the next. Examining patterns in establishment exit and entry helps policymakers answer questions about the extensive margins of economic activity, providing information about where and in what industries businesses are beginning or ending operations. Job creation and destruction focus on changes in employment within establishments. Job creation captures increases in employment from one year to the next, providing the number of jobs added each year. Job destruction, on the other hand, measures year to year decreases in employment, allowing us to total the number of jobs that ended each year.³ The BDS ties these two measures of business dynamics together by reporting job creation and destruction for all establishments but also separately for continuing, entering, and exiting establishments. This distinction enables

³ It is important to note that the BDS calculates job creation and destruction as net year-over-year differences in the level of establishment-level employment rather than the sum of flows of individual workers. The later concept is used in the Quarterly Workforce Indicators published by the Longitudinal Employer Household Dynamics (LEHD) program.

policymakers and researchers to determine the relative contributions of existing, entering, and exiting businesses to job creation and destruction.

The BDS is particularly useful for studying entrepreneurship and the formation of new firms. The BDS differentiates between new, start-up firms and existing firms by classifying entering establishments into firm age categories. If all the establishments at a new firm are in their first year of positive employment, the firm is labeled as a start-up, or age zero firm. In contrast, older firms may expand by opening new establishments, which is useful for understanding what types of firms survive and grow. Comparing job creation at entering establishments, stratified by firm age, provides information on the relative magnitude of both types of growth.

The BDS also provides information about firm death, identified when all establishments at a firm cease to have positive employment in a year (i.e., exit) and never reenter economic activity for the remainder of the time series. Firm death is distinct from the closing of establishments by continuing firms that may be winding down or reorganizing their activities. The BDS reports the total number of firm deaths in each year, as well as the associated number of establishments that died and the total employment lost as a result.

A final type of employment change is captured by counts of entering establishments

classified by establishment age. If an establishment exits from a positive employment state but returns to employment activity in a later year, the business will be labeled as an entrant but will not be age zero. Establishment entrants at older ages represent reactivations and are more common among small firms that operate at a single location. Measures of the number of reactivations in a geographic area, and the corresponding job creation, can be particularly useful following shocks to local economies by providing information on the number of previously existing businesses that were able to return to economic activity.

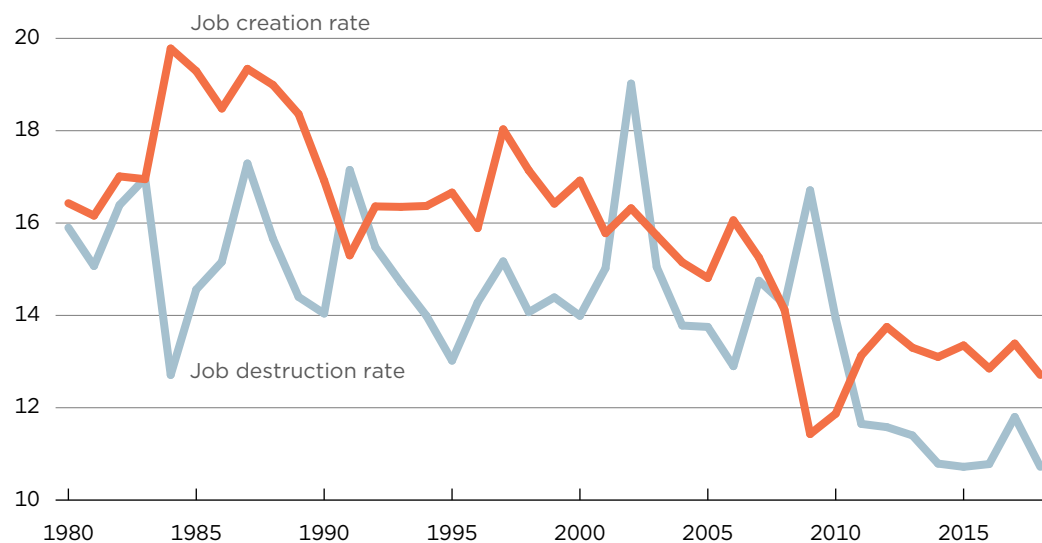
New BDS users are encouraged to begin their investigation of the data with the Economy-Wide Table (bds2018.csv) in order to familiarize themselves with the structure of the BDS. Many users will subsequently be interested in statistics at finer levels of granularity. The BDS includes an additional 77 tables that report establishment and job dynamics by both firm characteristics (firm size, firm age) and establishment characteristics (size, age, geography, and industry) and cross tabulations thereof. A complete list of all tables, as well as further details on BDS methodology, definitions, and source data, is available on the BDS home

page at <www.census.gov/programs-surveys/bds.html> and in Chow et al. (2021) Section 11.

Trends in Business Dynamism

The BDS tables can be used to investigate long-run trends in employment flows, reallocation, and start-up activity. Job creation and job destruction rates capture the total share of jobs created and destroyed in the economy each year. Figure 2-1 displays these measures from 1980 through 2018, showing a significant decline in employment flows over the past 4 decades. In the late 1980s, the job creation rate was roughly 19 percent and the job destruction

Figure 2-1.
Job Creation and Job Destruction Rates
(Percent)



Note: The job creation rate is 100 times the sum of all positive employment changes at establishments that expanded their employment, divided by the sum of average establishment-level employment between year t and $t-1$. Job destruction rate is calculated similarly by dividing the sum of all negative employment changes by the same denominator.

Source: U.S. Census Bureau, 2018 Business Dynamics Statistics.

rate averaged about 15 percent. In contrast, after 2010, the job creation rate averages about 13 percent, falling by nearly a third. In similar fashion, the job destruction rate declined by nearly a quarter to about 11 percent after 2010.

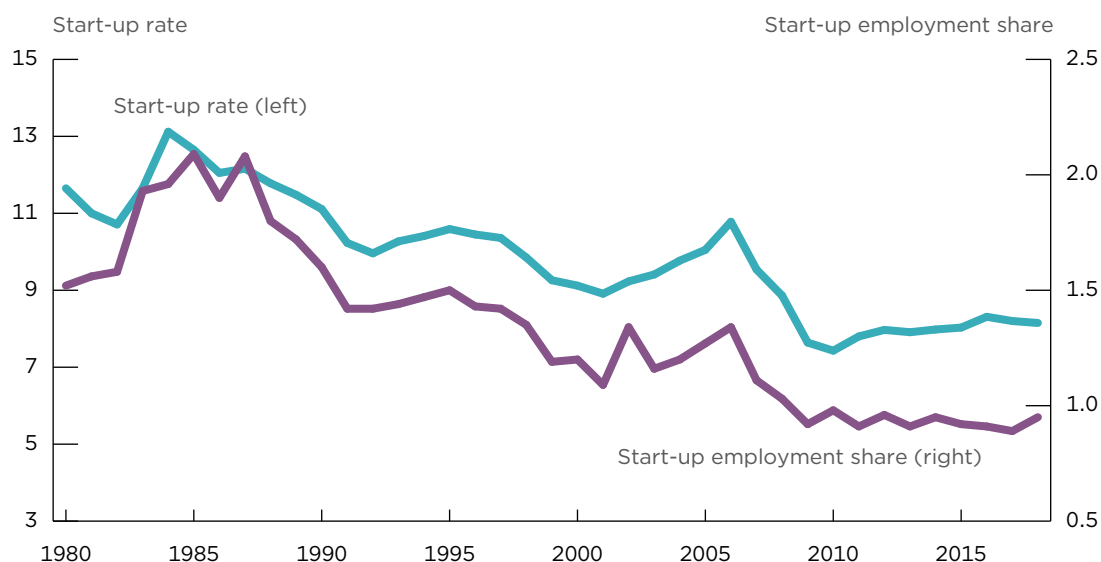
Another key insight made possible by the BDS is that start-up activity has declined precipitously over the same period (Figure 2-2). In the late 1980s, about 12 percent of firms in a year were start-ups. After 2010, the start-up rate stabilized at about 8 percent, falling by a third. The share of employment at start-ups shows a similar pattern, falling from about 1.9

percent of all employment being at start-ups in the late 1980s to about 0.9 percent after 2010. These patterns are important because of the role young firms play in job creation. Young firms on average experience an up-or-out dynamic, in which many fail but a few survive and grow quickly, contributing disproportionately to net job creation (Decker et al., 2014). Research using the LBD microdata has also shown that young firms tend to be more innovative (Acemoglu et al., 2018).

A significant improvement to the BDS made possible by the LBD redesign is the release of detailed geographic tabulations.

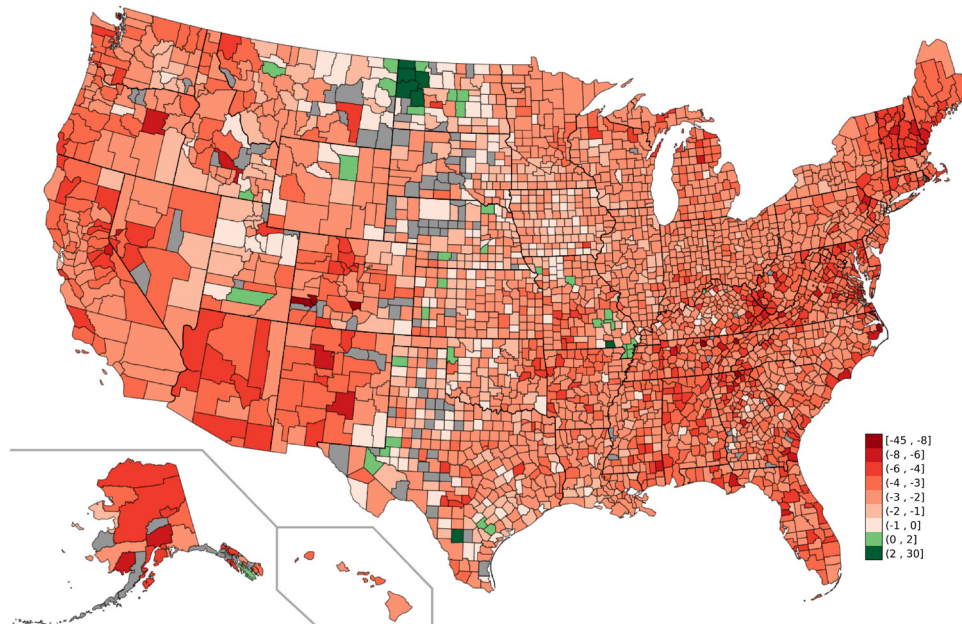
Using counts of firms by county and firm age categories, we can explore heterogeneity in the decline of start-up activity across geographies. Figure 2-3 shows the change in the start-up rate between the late 1980s and post-2010 by county. The darkest red counties experience the largest declines in their start-up rate, while the darkest green counties saw an increase in the start-up rate. The decline in start-up activity is very widespread. Over 94 percent of counties saw a decline in their start-up rate over this period—only 43 of over 3000 counties saw an increase in the share of start-ups. The five

Figure 2-2.
Start-Up Rate and Start-Up Employment Share
(Percent)



Note: The start-up rate is 100 times the count of all aged zero firms in a given year divided by the total number of active firms that year. The start-up employment share is 100 times the total employment at aged zero firms divided by the sum of average establishment-level employment between year t and $t-7$.
Source: U.S. Census Bureau, 2018 Business Dynamics Statistics.

Figure 2-3.
Change in Start-Up Rate by County



Note: The start-up rate is 100 times the count of all aged zero firms in a given year divided by the total number of active firms that year. Map shows the difference in the average county-level start-up rate between 1985 and 1989 and the average county-level start-up rate between 2010 and 2018. Grey cells have at least one suppression in at least 1 year, which prevented the calculation of an average start-up rate.

Source: U.S. Census Bureau, 2018 Business Dynamics Statistics.

counties that saw the largest increase in start-up activity are all in North Dakota. Using the state-sector-firm age table, we can see that this was driven by a significant increase in the average number of new firms in the Mining, Quarrying, and Oil and Gas Extraction (NAICS 21), Construction (NAICS 23), and Transportation and Warehousing (NAICS 48-49) sectors.

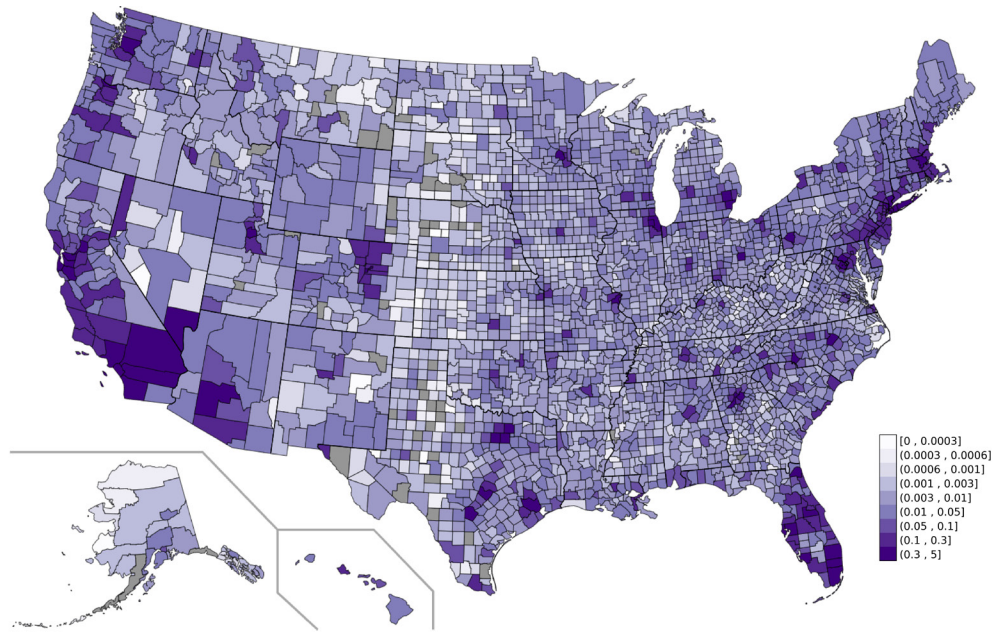
To understand the change in the start-up rate across geographies, it is helpful to keep in mind where most start-ups originate. Figure 2-4 shows each county's share of all start-ups averaged between 2016 and 2018, with the darkest purple counties

accounting for the greatest share of start-ups. Start-up activity tends to be greatest on the Northeast and Pacific coasts as well as city centers in the Midwest and South. Los Angeles County alone accounts for 4.3 percent of all start-ups. The 20 counties with the largest number of start-ups account for nearly a one-quarter of all start-ups in this time period.

The map in Figure 2-4 suggests that start-up activity is currently relatively concentrated in population centers. In addition, Figure 2-5 shows that this concentration has been rising over the last 20 years. After declining in the 1980s and early 1990s, the percentage of all start-ups

located in the 20 counties with the most employment rose steadily from approximately 19 percent in 1995 to about 23 percent after 2015. This trend is not solely driven by increased concentration of employment and population in large counties. While the share of overall employment in the 20 largest counties also declined after the early 1980s, it did not begin to increase again until the 2010s and even then only rose by less than a percentage point. These trends indicate that large employment centers experienced growth in their share of start-up activity beyond what might have been predicted by a general rise in economic activity in these areas.

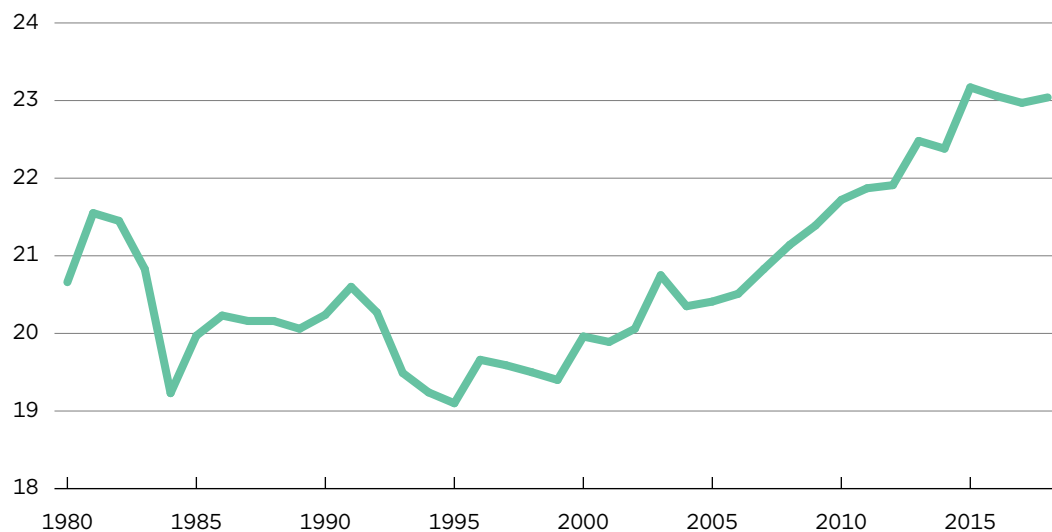
Figure 2-4.
Share of All Start-Ups by County



Note: The start-up share is the count of all aged zero firms in a given county divided by the total number of start-ups nationwide in that year, averaged across 2016–2018.

Source: U.S. Census Bureau, 2018 Business Dynamics Statistics.

Figure 2-5.
Share of All Start-Ups in the 20 Largest Counties by Employment
(Percent)



Note: Figure shows the percentage of all start-ups each year located in the 20 counties with the most employment. The set of counties with the most employment changes over time.

Source: U.S. Census Bureau, 2018 Business Dynamics Statistics.

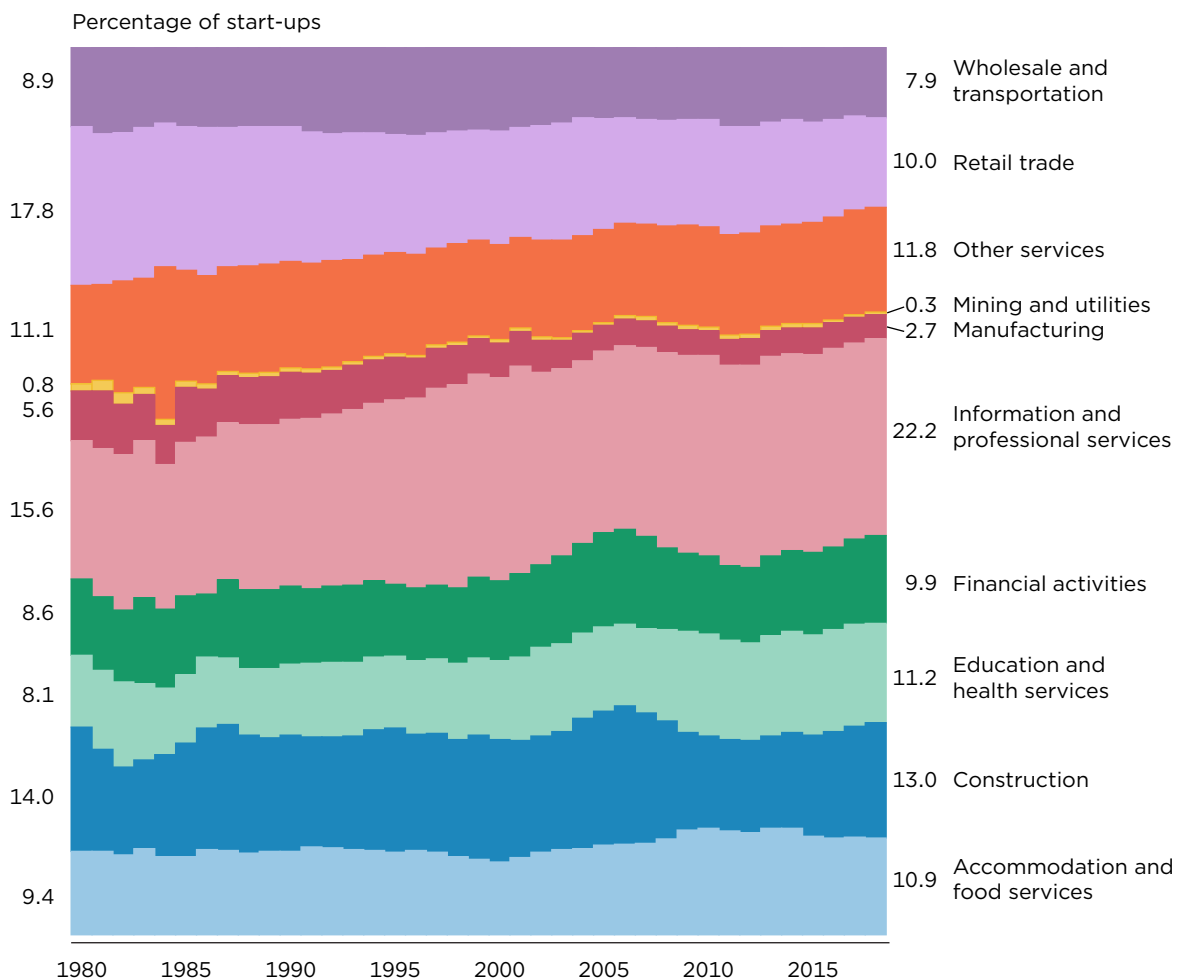
The sectoral composition of start-ups has also changed significantly over time (Figure 2-6). The percentage of start-ups in retail trade has fallen from 17.8 percent in 1980 to 10 percent in 2018. Manufacturing's share of all start-ups over the same period fell by about one-half, from 5.6 percent to 2.7 percent. Other sectors that increased their share of start-ups included Information and

Professional Services (NAICS 51 and 45), Education and Health Services (NAICS 61 and 62), and Accommodation and Food Services (NAICS 72). This relatively simple exercise, of measuring the changing industry composition of start-ups, relies on complex longitudinal industry linking and concordances built into the redesigned LBD. These algorithms produce a vintage-consistent industry

classification that account for the changing industrial classification systems used in the data over this long time period.

Users can construct their own BDS graphics using BDS Explorer, a data visualization tool intended to make the BDS easily accessible for people with all levels of data experience. With this tool, users can choose years, industry groups, type of

Figure 2-6.
Start-Up Sectoral Composition Over Time



Note: Figure shows the percentage of all start-ups by 10 groupings of 2-digit sectors each year.
Source: U.S. Census Bureau, 2018 Business Dynamics Statistics.

geography, firm age category, and firm size category and then produce graphs, maps, or tables that display statistics. The data can also be downloaded in tabular format. BDS Explorer is available at <www.census.gov/data/data-tools/bds-explorer.html>.

Reengineering and Redesigning the LBD

We now turn to a more detailed description of the LBD production process with a particular focus on the improvements made during the transition to a formal production system. For additional details on how the LBD is produced, we refer interested readers to Chow et al. (2021).

One of the most significant challenges in creating a longitudinal database spanning over 40 years is consistency of data elements over time. In addition to changing geographic identifiers, industry codes, payroll units, and processing flags to have standard definitions over time, the new production system also improved scope and data quality by combining and reconciling microdata from both the BR and the County Business Patterns (CBP) throughout the entire time series. The CBP, another derivative product of the BR, makes important and economically meaningful edits during its production process that now feed into the LBD and BDS production process. As part of the BR-CBP reconciliation process, the LBD team located many years of additional CBP data not stored in the main CBP repository. These efforts

included recovering 1976–1984 CBP microdata files from legacy Census Bureau tapes and translating the files into a modern storage format, allowing them to be incorporated into the production system. These efforts helped to attenuate large, spurious changes in job creation and destruction in the early years of the data.

Even with consistent data elements, tracking establishments over time remains challenging. For example, businesses sometimes change the employer identification number (EIN) they use to file payroll taxes. These types of changes make it difficult for Census Bureau staff who maintain the BR to know whether a business continues to operate from one year to the next. When a tax record for a new EIN that has not previously existed in the BR appears, the BR staff cannot be sure whether it is a new business or an old business that has simply changed its EIN. Similarly, if a tax report for an already existing EIN is not received, it is difficult to know whether the business has died or filed under a new EIN. This problem is especially pronounced for small, single-establishment firms that are only surveyed once every 5 years as part of the quinquennial economic census. Without additional linking to identify such reorganizations, the BDS would overstate the number of businesses that are born and die each year. LBD processing addresses these issues with several matching methods, including name and address matching, that identify business reorganizations.

Another challenge to producing measures of dynamism arises from firms reorganizing and changing their associated establishments. Those changes can take the form of acquisitions, divestitures, or opening or closing establishments. To track changes in firm structure, the Census Bureau conducts the annual Company Organization Survey (COS), supplementing the organization information collected in the economic census. Importantly, only relatively large firms are surveyed in the COS. Hence, for many firms, the organizational structure recorded in the BR is only updated every 5 years. Without additional processing, the BR will show large spikes in the number of establishments that are born and die in economic census years. The LBD addresses this challenge with algorithms that retime economic census year births and deaths associated with small- and medium-size firms not covered by the COS. In particular, a formal statistical model is used to impute first or last year of operation for establishments that appear to be entrants or exits at those firms.

As described above, industry classification systems have changed substantially over time, making it hard to compare the composition of industry activity in the 1980s to that in the 2010s. The new LBD production system incorporates algorithms that assign vintage-consistent industry codes that produce comparable measures at the industry-level across all years covered by the LBD. Currently,

this process generates 2012 NAICS codes for every establishment, with 2017 NAICS codes planned for the near future.

Using the links created between each consecutive pair of years, we assign each establishment a unique longitudinal identifier, *lbdnum*, that allows us to follow an establishment over time. We create annual establishment and firm files by combining the longitudinal linkages and cross-sectional attributes drawn from the BR and CBP files. These annual LBD files are used by Census Bureau staff to create the BDS and by internal and external researchers in myriad ways. Census Bureau staff also add *lbdnum* to other research-use business datasets to allow even more data to be combined and utilized.

Following CBP data products, the new BDS tables use multiplicative noise to avoid the disclosure of sensitive information (Massell and Funk, 2007). Utilizing more modern disclosure protection methods allows the BDS to produce more detailed tables and be consistent with methodologies used in other establishment-level statistics published by the Census Bureau. Although noise is the primary method for protecting the data, we continue to suppress cells that do not meet minimum count requirements.

A final consequential change to the LBD is the improved documentation and transparency that resulted from its transition to formal production processing. The underlying code and code specifications for the LBD are available to researchers with

approved projects via the FSRDC network, allowing microdata users to better understand and help improve the processing of the LBD. A new CES working paper (Chow et al., 2021) describes both the production process and resulting LBD and BDS files in varying levels of detail that should be useful to users of both public-use tabulations and confidential microdata.

Future Improvements

After almost 3 decades of research on business dynamics using the LBD, a great deal has been learned about linking establishments over time. Census Bureau staff continue to investigate ways to improve the LBD and BDS through better linkages, additional data, and newer modeling tools. Here we highlight a few of our current research topics and invite the assistance of researchers interested in collaborating to improve the LBD and BDS data. A more complete discussion of these and other issues is contained in Chow et al. (2021).

One area of particular focus in CES is the measurement of firm death. Firm death is difficult to measure for small business entities because we cannot always distinguish between an exit from economic activity and missing data due to late or unfiled tax returns. Future reactivations also make initial counts of firm deaths in the latest years of the data inaccurate until subsequent years of data are added to the time series. Given the economic impact of the COVID-19 pandemic, more accurately

measuring firm deaths in the LBD and BDS will be an essential task.

Another area in which the LBD-BDS team hopes to improve measurement is through the use of person-level W-2 tax filings. These person-level records can be linked to the BR and could be used to impute/confirm missing employment, to identify firm reorganizations by tracing large groups of workers who move from one EIN to another, and to create additional worker-level detail for inclusion in the BDS such as the age/sex distribution of workers or the average 90-10 percentile earnings differential. Currently, CES has W-2 records for more recent years but is pursuing additional data to facilitate this research.

Finally, the LBD-BDS team is adding information about firms to the LBD in order to produce BDS tables with more detail. Plans are underway to add a goods-trader designation (importer, exporter, or both), patenting firm designation, and a high-tech industry designation (Kamal and Ouyang, 2020; Graham et al., 2018; Dreisigmeyer et al., 2018; Goldschlag and Miranda, 2020). These additional firm and establishment characteristics will allow us to produce BDS tables of establishment and employment flows for globally-engaged, patenting, and high-tech businesses. By building a formal production process, the Census Bureau has created a system that will be able to provide meaningful information about business dynamics for many years to come.

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Chapter 3.

Introducing the Nonemployer Statistics by Demographics (NES-D)

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Nonemployer Statistics by Demographics (NES-D) is a new annual statistical series that leverages existing administrative records and U.S. Census Bureau data to provide nonemployers' demographics estimates by geographic and industry detail, receipt-size class, and legal form of organization. Nonemployers (i.e., businesses with no paid employees) account for the vast majority of all businesses in the United States, and close to 90 percent of them are sole proprietorships—businesses with just one owner that we usually think of as the “self-employed.” In 2017, there were approximately 25.7 million nonemployer firms, representing about 81.7 percent of all U.S. businesses, though just 3.3 percent of total receipts.

While employer firms have traditionally captured the attention of researchers and policymakers, nonemployers have gained their interest in recent years. In the last decade, nonemployer business growth has outpaced that of employer firms, and there has been a surge in the number of nonemployer “gig workers” in particular (i.e., those engaged in flexible, temporary, or freelance jobs). Recently, applications for an employer identification number (EIN) have seen a sharp increase during the pandemic, and studies suggest that a large share of those applications may become nonemployers (Dinlersoz et al.,

2021). Pertinently, the growth in the share of nonemployer businesses has differed across demographic groups, with the share of minority ownership increasing over time, reflecting trends in rising minority population as well as in rates of minority entrepreneurship. This increases the importance of understanding the details of nonemployer ownership trends and how business cycles and (general or localized) shocks differentially affect these groups.

To this end, in 2020, the Census Bureau launched the NES-D series, which includes annual statistics on the number of nonemployer businesses and their receipts by owner sex, ethnicity, race, and veteran status. Additional detail is available by industry (2- and 3-digit NAICS), geography (state and metropolitan area), receipt-size class, and legal form of organization, as well as some additional demographic characteristics on owners, including age, foreign-born status, and citizenship status.

Because NES-D is based on the universe of nonemployers, it offers a greater possibility of providing statistics at detailed levels of geography, even for small demographic groups. In contrast, business surveys based on samples must often suppress this type of information for disclosure avoidance and/or quality reasons. In

addition, NES-D's annual frequency improves upon its predecessor. Publishing statistics at a higher frequency and with the most detailed geographic level possible helps a broader base of stakeholders, including community and economic development organizations, regional planning agencies, and groups working on improving diversity in the small business community. NES-D data are currently available for reference year 2017, with planned annual releases and the goal of increasing geographic and industry detail in the future. NES-D microdata will be available to researchers through the federal statistical research data centers in the near future.

In this chapter, we provide an overview of NES-D—its development, methodology, and challenges—and highlight some of its results. More in-depth discussions are available in Luque et al. (2019a, 2019b).

The Development of NES-D

Overview

Until recently, the quinquennial Survey of Business Owners (SBO) was the source of information on business owner demographic characteristics, such as race, ethnicity, sex, and veteran status, for both employers and nonemployers. NES-D is the successor of the SBO's nonemployer component and

provides high-quality demographic estimates that are more frequent and timely, with fewer imputations, no additional respondent burden, and lower costs.

NES-D is not a survey. Rather, it is an example of the Census Bureau leveraging existing administrative records (AR) and Census Bureau data to create an innovative product that addresses the challenges of survey-based data while producing statistics that are of equal or better quality. NES-D links demographic characteristics from AR and Census Bureau sources to the vast majority of the nonemployer universe, from federal tax records, to produce annual series of nonemployer counts and receipts by owner demographics, geography, industry, receipt-size class, and legal form of organization (LFO). Coupled with the new Annual Business Survey (ABS), which supplies demographic characteristics for employer firms, the Census Bureau now produces annual business owner demographics for all U.S. firms through a blended-data approach that combines AR-derived estimates for nonemployer businesses (NES-D) and survey-derived estimates for employer businesses (ABS).

NES-D was initiated by the Census Bureau's Economic Reimbursable Surveys Division and involved collaboration between multiple divisions within the agency. This work also benefited from the feedback and support of various stakeholders, including the Small Business Administration

Office of Advocacy (who also provided financial support), the National Women's Business Council, the Minority Business Development Agency, and veterans' groups. The research phase began in April 2018 at the Center for Economic Studies and culminated with the first official release in December 2020, when the 2017 SBO estimates would normally have been released.

The first step in development was to assess the viability of linking and estimating nonemployer demographics exclusively with AR and Census Bureau data. This work was grounded in previous research showing the quality and suitability of these data sources in replacing demographic information in other contexts (Luque and Bhaskar, 2014; Rastogi and O'Hara, 2012). We first evaluated coverage rates for a single year (2015), identified methodological and data challenges and limitations, provided evidence and results based on alternative methodologies and data sources, and produced preliminary tabulations.

Once a preferred methodology consistent with that used in the employer-only ABS was identified, we evaluated additional coverage from secondary and tertiary data sources, examined the longitudinal consistency of data coverage as well as of our AR-based demographics estimates, and explored estimates at the subnational level and by industrial sector. We also tabulated demographics estimates of business receipts and counts, and implemented imputation

of missing demographic values. The imputation methodology followed the one used for employer firms in the ABS by the Economic Directorate.

Our coverage and longitudinal consistency evaluation showed that AR coverage rates are high and stable over time. We are able to identify owners for approximately 99 percent of nonemployer businesses (not including C-corporations), 92 percent to 93 percent of identified nonemployer owners have no missing demographics, and only about 1 percent were missing three or more demographic characteristics. For all demographic characteristics, our estimates also showed stability and no sharp fluctuations over time at the national, state, and sector levels, while displaying some variation over time consistent with underlying population trends. These results provided the necessary evidence to move forward and produce official nonemployer business demographics statistics by blending AR and Census Bureau data sources.

How Is NES-D Created?

NES-D's creation relies on administrative records obtained by agreement from other government agencies, including the Internal Revenue Service (IRS), the Social Security Administration (SSA), and the U.S. Department of Veteran Affairs (VA), as well as Census Bureau data. In particular, relying on our colleagues in the Economic Directorate, the nonemployer universe is extracted from the Census

Bureau's Business Register (BR), which contains information on receipts, industry, geography, and LFO of each business. Nonemployers are businesses with no paid employment or payroll, with annual receipts of \$1,000 or more (\$1 or more in construction industries), and filing tax forms for sole proprietorships (Form 1040, Schedule C), partnerships (Form 1065), or corporations (the Form 1120 series).

The primary source of data for race and Hispanic origin information is the decennial census and the American Community Survey (ACS), with the SSA Numident serving as a secondary source. The Numident is also the primary source for the sex, age, place of birth, and citizenship status of the business owner, with Census Bureau data serving as a secondary source. Finally, the VA's USVETS data provides information on veteran status.

To link demographic characteristics to the business owners, we use the Census Bureau's Protected Identification Key (PIK). PIKs are anonymized unique individual identifiers used for linkage across data sources. Depending on the LFO of the business, two IRS forms are used to obtain PIKs. In the case of sole proprietorships, the business identifier coincides with that of its owner—it is simply the owner's PIK or anonymized Social Security Number (SSN) from IRS Form 1040. In the case of partnerships and S-corporations, we obtain owner PIKs from Schedule K-1 data since these data contain

the EIN identifying the partnership or corporation itself, as well as the PIKs of the owners of that business. The K-1 record also includes the share of the business owned by each owner. This information is critical in assigning demographic characteristics at the firm level since there can be more than one owner and not all owners are necessarily individuals.

In particular, NES-D assigns firms to demographic groups by first determining the total share of firm ownership held by individual members of each group. Firm ownership is assigned to a given group if the owners in that group collectively own a majority stake (more than 50 percent). Those characteristics with only two categories at the individual level (e.g., sex, Hispanic origin, and veteran status) have a third category at the firm level: equally-owned. So, for example, a firm can be female-owned, male-owned, or equally-owned by men and women. Finally, following the methodology used in the ABS and the SBO before it, only firms where the person with the largest ownership share owns at least 10 percent are eligible for demographic assignment, up to four of the largest owners are considered in the assignment, and only *person* owners are used in the estimation.

Ongoing Challenges

The challenges we encountered along the way range from those related to methodology and data limitations to administrative issues such as data agreements and delivery schedules. A

number of ongoing challenges remain.

First, veteran status presents a challenge since the ABS (and the SBO before it) uses a broader definition than the one reflected in the VA's data. Specifically, the questions in the ABS ask whether the business owner is or has been on active duty in the U.S. military or National Guards or Reserves, while the VA defines a veteran as someone who has served on active military duty in the past. To address this issue, we are currently exploring Department of Defense data to better align NES-D with the ABS.

Another AR data limitation that we are currently addressing is whether and how to impute demographics for nonemployer C-corporations. In the United States, there is no tax form or business registry that unequivocally identifies owners of C-corporations. Currently, NES-D does not include these entities. Fortunately, they account for only 1.5 percent of nonemployer businesses and 3.8 percent of nonemployer receipts.

Previous studies (Liebler et al., 2017) have also found that survey race and ethnicity responses and AR data have lower agreement rates for small size populations (i.e., American Indian and Alaska Native [AIAN], Native Hawaiian and Other Pacific Islander [NHOPI], and multiracial) relative to other race groups, and for Hispanics relative to non-Hispanics. One of our goals is to pursue additional AR sources that can

provide better coverage of these populations.

NES-D in Action

NES-D's business demographics estimates are used by a variety of stakeholders, from advocacy groups and local governments to researchers and business owners themselves. For instance, the Small Business Administration and the Minority Business Development Agency use them to assess business assistance needs. Federal, state, and local government agencies can use them for planning and evaluating programs targeting disadvantaged groups. They also help individual business owners examine their growth in comparison to similar firms. Below, we take a look at

some illustrations of NES-D's statistics.

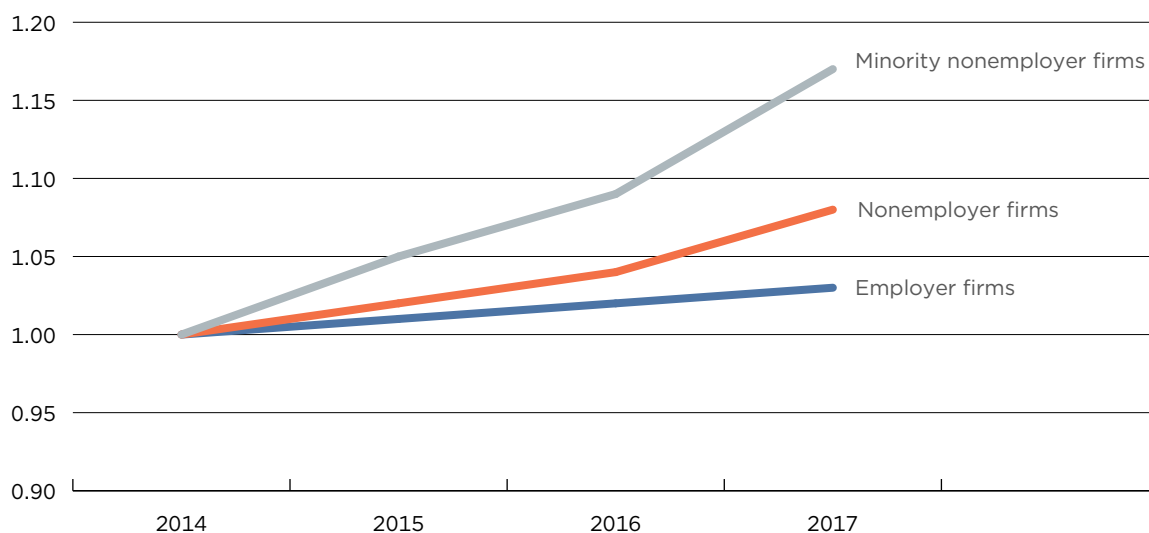
The 2017 NES-D publication consists of four tables. Three tables provide counts and receipts of nonemployer firms by race, Hispanic origin, sex, veteran status, LFO, receipt-size class, geography, and industry. The fourth table provides counts of nonemployer business *owners* by demographics (i.e., race, Hispanic origin, sex, veteran status, age, foreign-born, and U.S. citizenship status), geography, and industry. Geographic detail includes MSA, state, and national estimates, while industry detail includes 2- and 3-digit NAICS.

The share of nonemployer business ownership of some

race groups and veterans are similar to or higher than their shares in the U.S. population. For instance, in 2017, Black or African Americans were about 12 percent of nonemployers and about 13 percent of the U.S. population, Asians were approximately 8 percent of nonemployers and about 6 percent of the U.S. population, Whites represented about 80 percent of nonemployers and 73 percent of the U.S. population, and veterans were about 6 percent of both. In contrast, women represented about 51 percent of the U.S. population but only 42 percent of nonemployer business ownership. In terms of trends, the nonemployer population generally follows that of the underlying U.S. population,

Figure 3-1.

Trends in Employer, Nonemployer, and Nonemployer Minority Firms: Indexed Number of Firms (2014 Base Year)



Sources: U.S. Census Bureau, 2017 Nonemployer Statistics by Demographics (NES-D), Luque et al. (2019b), 2014–2017 Nonemployer Statistics, and 2014–2017 Statistics of U.S. Businesses.

with the shares of minority-owned nonemployer businesses increasing slightly over the period of 2014–2017 (Figure 3-1), women-owned businesses remaining stable (not shown), and veteran-owned businesses decreasing slightly (not shown). In NES-D, the minority category is comprised of individuals classified as any race and ethnicity combination other than non-Hispanic and White.

Meanwhile, differences in firm receipts are pervasive across minority, women, and veteran-owned nonemployer

businesses. The average nonemployer (excluding C-corporations) had receipts of \$47,000 in 2017, but the average receipts for women (\$27,000), veteran (\$42,000), African American (\$22,000), AIAN (\$32,000), NHOPI (\$33,000), and Hispanic (\$36,000) nonemployers were below that average. Both Asian and White nonemployers averaged approximately \$48,000 in receipts. As an illustration, Figure 3-2 depicts the share of nonemployer ownership by sex in 2014 and 2017, in terms of

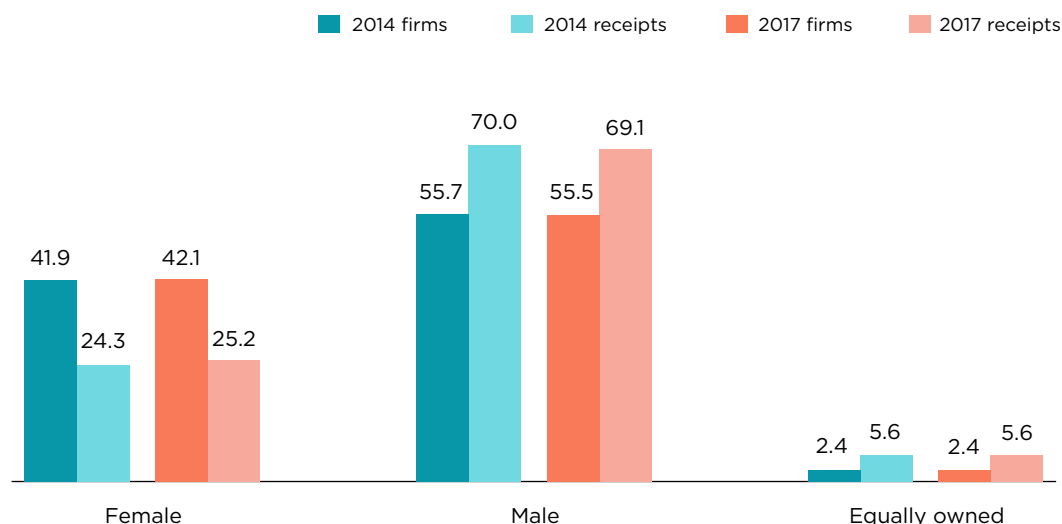
the number of such firms and receipts.

Nonemployer demographics by state also generally reflect underlying state populations and their growth. For instance, the five states with the largest percentages of minority-owned nonemployer firms were Hawaii (54.6 percent), DC (50.4 percent), Texas (49.3 percent), Florida (49.2 percent), and California (47.9 percent), which are also the states with the largest shares of minority population with the exception of Florida. As might be

Figure 3-2.

Share of Nonemployer Firms and Receipts by Owners' Sex: 2014 and 2017

(In percent)



Sources: U.S. Census Bureau, 2017 Nonemployer Statistics by Demographics (NES-D) and Luque et al. (2019b).

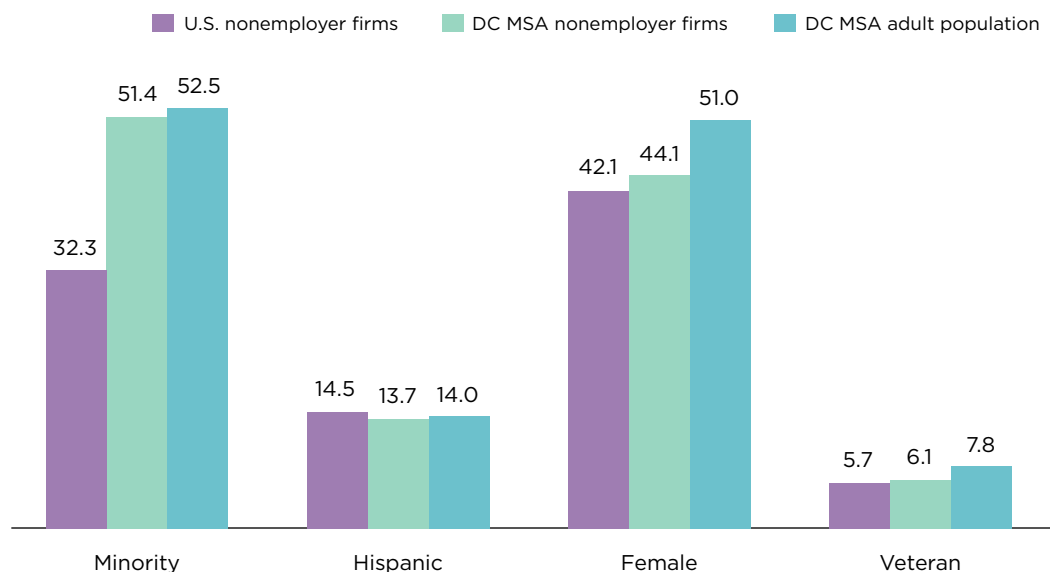
NONEMPLOYER STATISTICS BY DEMOGRAPHICS (NES-D) FOR LOCAL AND REGIONAL ANALYSIS

Exploring demographics at the local level can help local and state governments tailor regulations and policies, and also help community and economic development organizations, regional planning agencies, and groups working on improving diversity in the small business community. The accompanying figure illustrates nonemployer ownership in the Washington, DC Metropolitan Statistical Area (MSA) in 2017. We see that minority nonemployer business ownership is considerably higher than their

nationwide share and slightly lower than their adult population share. Female and veteran nonemployer ownership shares are also larger in the DC region relative to their national average, although female ownership is lower than the female adult population. Interestingly, average nonemployer receipts (not shown here) are higher in the Washington, DC MSA than the national average for female, Hispanic, veteran, and all race groups except Asian.

Shares of Nonemployer Firms and Adult Population in the Washington, DC Metropolitan Statistical Area (MSA): 2017

(In percent)



Note: Adult population refers to those aged 18 or older.

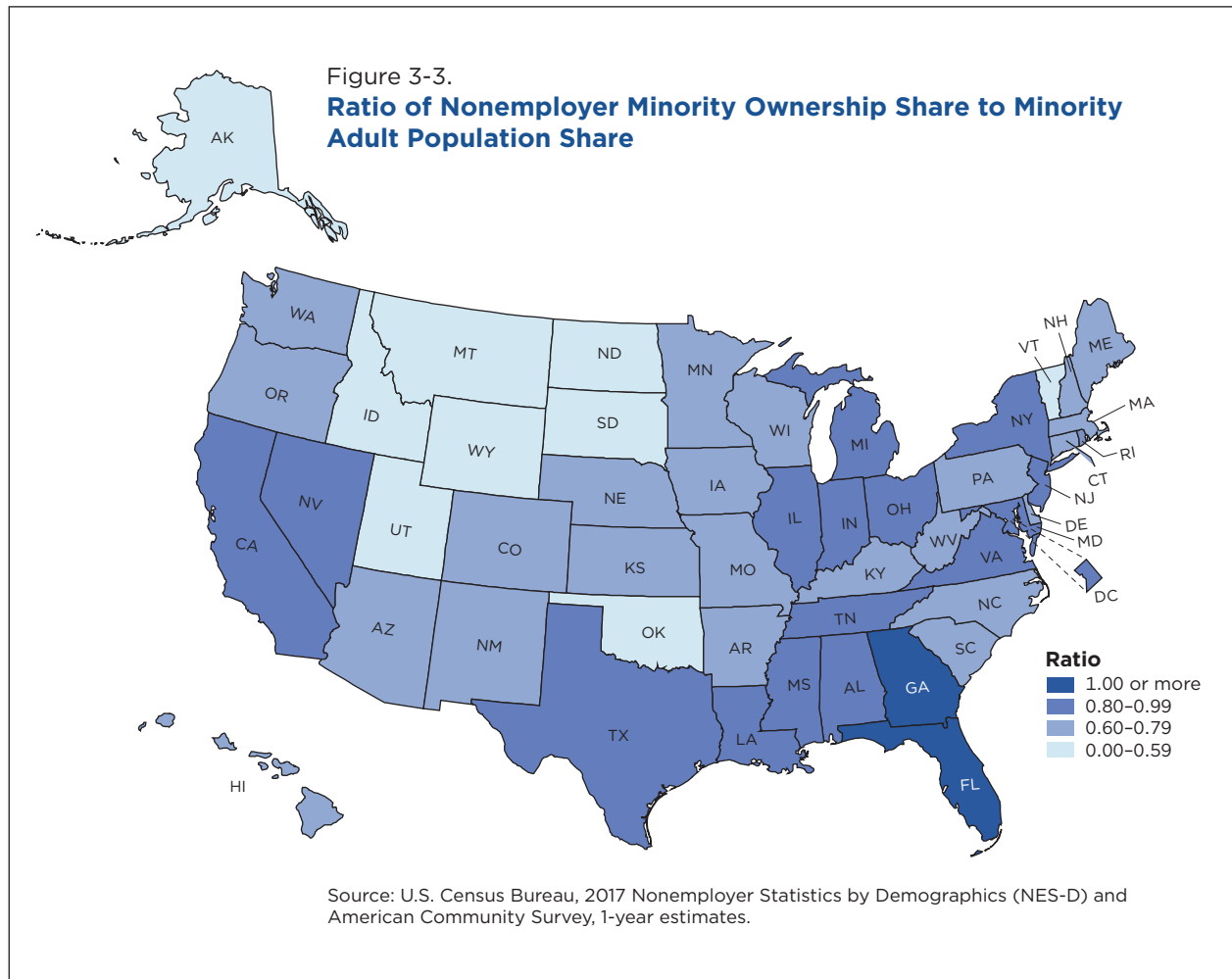
Source: U.S. Census Bureau, 2017 Nonemployer Statistics by Demographics (NES-D) and 2017 American Community Survey, 1-year estimates.

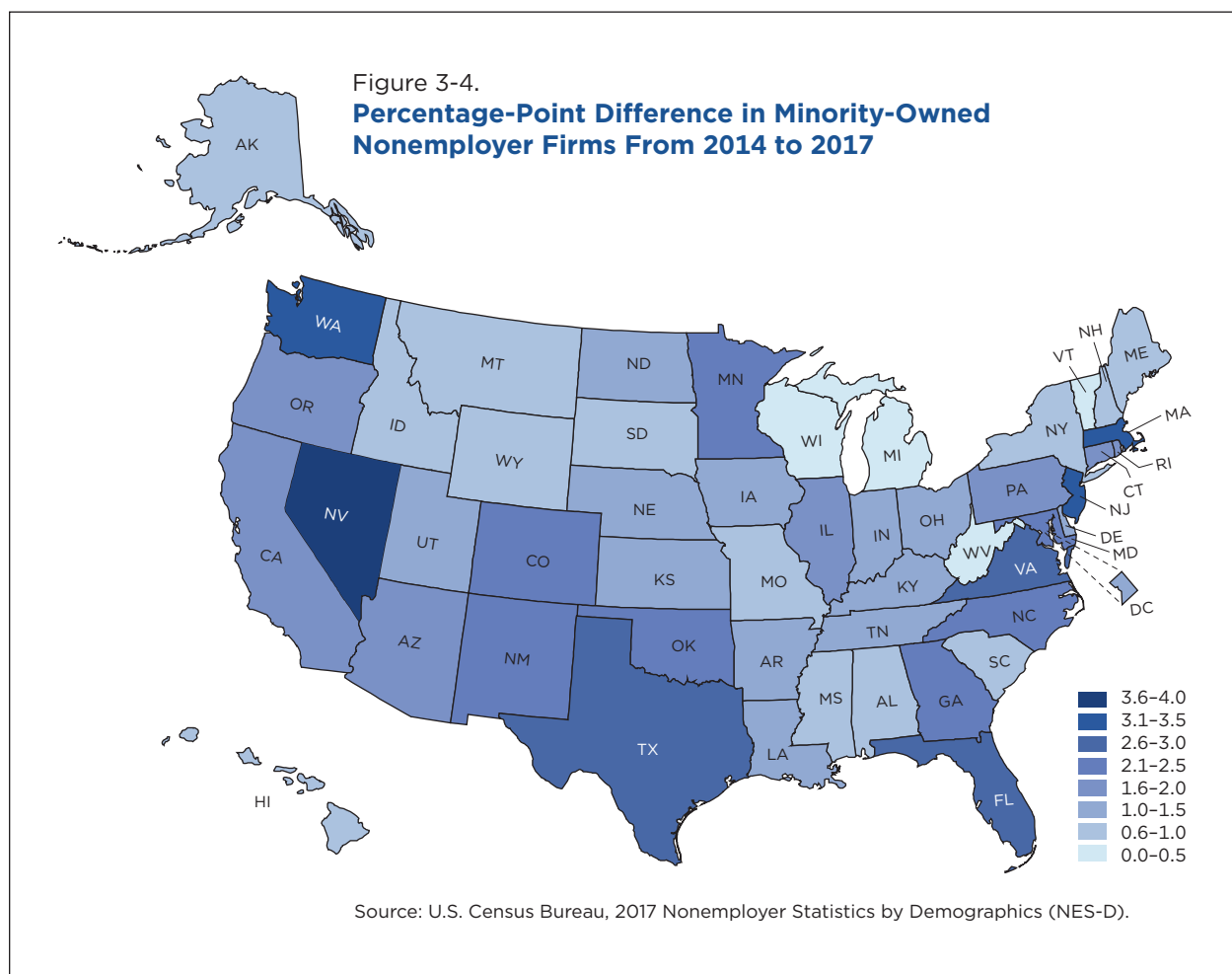
expected, we see wide variation across states in the share of firm ownership by race, Hispanic origin, and minority, and much less variation in ownership by sex, which ranges from approximately 38 percent in New Jersey, Maine, and

Delaware to about 48 percent in Washington, DC.

NES-D can also help us identify states where nonemployer firm ownership by a particular demographic group might be higher or lower relative to their share of the state's population,

or more pertinently, adult population (those 18 years of age or older). For instance, Figure 3-3 compares a state's nonemployer minority ownership share to its minority adult population share. A low value of this ratio indicates that the share of non-employer minority ownership





is lower relative to the state's adult minority population share. Values of (or above) 1 indicate that minority ownership among nonemployers is the same as (or higher than) the underlying minority population in the state. Figure 3-4 shows the growth of minority-owned nonemployer firms from 2014 to 2017 by state.

One can also use NES-D to examine nonemployer ownership by industry. In 2017, nonemployer minority ownership

was highest in Transportation and Warehousing (56.1 percent), Accommodation and Food Services (46.7 percent), and Health Care and Social Assistance (43.9 percent), and smallest in Mining (7.1 percent). The higher shares were driven by the Transit and Ground Passenger Transportation (NAICS 485), Food Services and Drinking Places (NAICS 722), Ambulatory Health Care Services (NAICS 621), and Social Assistance (NAICS 624) industries. The Transit and Ground

Passenger Transportation industry (which includes taxi and limousine services, as well as ridesharing) also experienced the largest nonemployer growth from 2016 to 2017. In this industry, the share of nonemployer firms and receipts that are minority-owned (62.6 percent and 67.3 percent, respectively) is considerably higher than the minority-owned national average (32.6 percent and 24.6 percent, respectively).

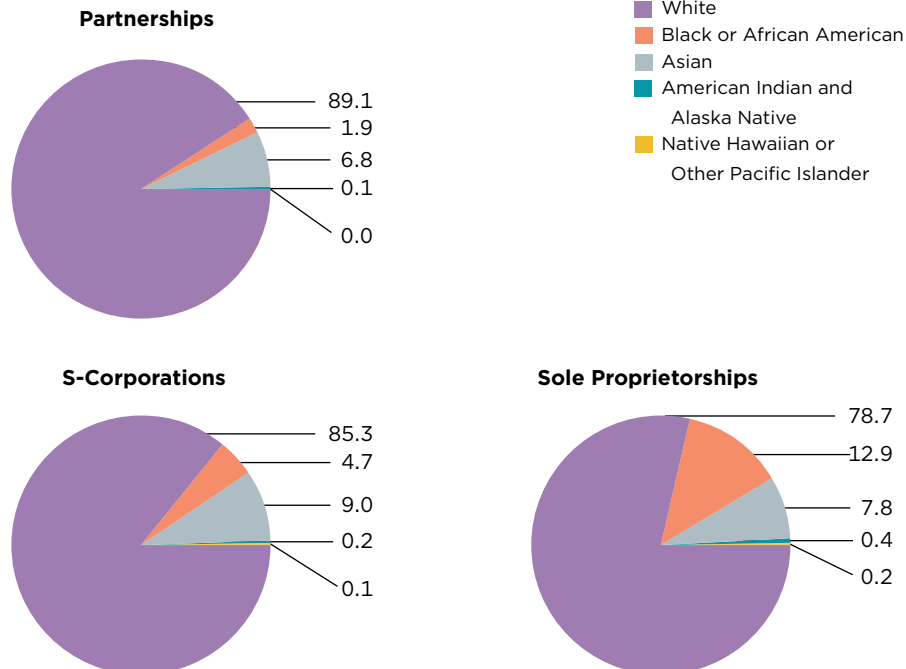
A NEW DIMENSION: LEGAL FORM OF ORGANIZATION

Nonemployer Statistics by Demographics (NES-D) provides nonemployer demographics by legal form of organization, a dimension that the legacy Survey of Business Owners did not offer. Legal form of organization (LFO) can be an important piece of information about a firm since it may signal the expected strategy, behavior, and “complexity” of a business, along with the different barriers and limitations it may face. Most nonemployers are sole proprietors (about 86 percent as of 2017) followed by partnerships, S-corporations, and C-corporations (approximately 7 percent, 5 percent, and 2 percent, respectively, as of 2017). Nonemployers vary considerably by LFO. Compare, for instance, the average receipt of about \$35,000 for sole proprietorships versus approximately \$142,000 for partnerships, \$121,000 for S-corporations, and \$119,000 for C-corporations.

Thanks to NES-D, we can now explore the demographic composition of nonemployer firms across LFOs. For example, as depicted here in 2017, partnerships and S-corporations had higher White ownership shares (approximately 89 percent and 85 percent, respectively) relative to sole proprietorships (approximately 79 percent). In results not shown here, Hispanic ownership of partnerships is very low, only about 4 percent, relative to the approximately 16 percent and 11 percent of sole proprietorships and S-corporations, respectively. Also, the shares of female and female-male ownership make up about 45 percent of the ownership in partnership firms. Male-only ownership accounts for about 55 percent in both partnerships and sole proprietorships, and 64 percent in S-corporations.

Race Ownership Shares of Nonemployer Firms Across Legal Form of Organization: 2017

(In percent)



Source: U.S. Census Bureau, 2017 Nonemployer Statistics by Demographics (NES-D).

Nonemployer female ownership also showed wide sector variation. It was highest in Health (75.3 percent), Education (61.5 percent), Retail Trade (57.0 percent), and lowest in Construction (10.4 percent). Both minority and female ownership was relatively low in some of the otherwise large nonemployer sectors such as Real Estate.

Conclusion and Next Steps

NES-D embodies an innovative approach to producing business statistics, but also and importantly, it is well-grounded in a body of administrative records research that has demonstrated the quality and suitability of the data sources employed in NES-D. NES-D also exemplifies the results that can be accomplished through a sustained and focused team effort involving staff from the Census Bureau's Research and Methodology and Economic Directorates, strong collaborations with stakeholders, and the application of sound methodologies.

Moving forward, NES-D's goals will continue to be driven by the needs of stakeholders, researchers, communities, policymakers, and the public as a whole. On the production front, we hope to shorten the dissemination lag from 3 years to 2 years, increase the level of both geographic and industrial detail in future releases, as much as the data and disclosure avoidance

rules allow, and produce tables of demographics for *all* businesses by summing together these AR-based nonemployer statistics and the survey-based employer demographic statistics from the ABS. We also plan to augment the set of nonemployer characteristics in NES-D, including ones related to the gig economy (e.g., does the nonemployer also work for wages? does the nonemployer use contractors?), transitions from nonemployer to employer status, household characteristics obtainable through IRS data (e.g., marital status, number of dependents, home ownership), firm age, exporter/importer status, and patenting activity.

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Appendix 1.

OVERVIEW OF THE CENTER FOR ECONOMIC STUDIES

The Center for Economic Studies (CES) partners with stakeholders within and outside the U.S. Census Bureau to improve measures of the economy and people of the United States through research and the development of innovative data products.

RESEARCH

CES research staff use confidential microdata from Census Bureau censuses and surveys of businesses and households, linked employer-employee data, and administrative records from federal and state agencies and other sources to carry out empirical research that leads to:

- Discoveries in economics and other social sciences not possible using publicly available data.
- Improvements in existing Census Bureau surveys and data products.
- Enhancements to micro-level datasets for researcher-use in the Federal statistical research data center (FSRDC) network.
- New statistics and information products for public use.

Research findings are disseminated through publications (Appendix 2), CES working papers (Appendixes 3 and 4), conferences, seminars, workshops, and this annual report.

PRODUCTS

CES uses microdata from existing censuses and surveys, and from administrative sources, to create innovative public-use data products, including:

- *Business Dynamics Statistics (BDS)*. Tabulations of establishment openings and closings, firm startups and shutdowns, and job creation and destruction with unique information on firm age and firm size.
- *Business Formation Statistics (BFS)*. Quarterly statistics on business applications and formations including projections for recent and future quarters.
- *Dispersion Statistics on Productivity (DiSP)*. Annual statistics on within-industry dispersion of productivity for the manufacturing sector.
- *Job-to-Job Flows (J2J)*. Statistics on worker reallocation, including job change, hires and separations from and to nonemployment, and characteristics of origin and destination jobs.
- *National Longitudinal Mortality Study (NLMS)*. Database for studying the effects of demographic and socioeconomic characteristics on differential in mortality rates.
- *OnTheMap*. Online mapping and reporting application showing where people work and workers live, with information on worker and business characteristics.
- *OnTheMap for Emergency Management*. Intuitive Web-based interface for accessing U.S. population and workforce statistics, in real time, for areas being affected by natural disasters.
- *Opportunity Atlas*. Interactive mapping tool showing measures of social mobility for every census tract in the United States.
- *Post-Secondary Employment Outcomes (PSEO)*. Statistics on the earnings and employment outcomes for college graduates by institution, degree field, and degree level.
- *Quarterly Workforce Indicators (QWI)*. Workforce statistics, including employment, earnings, job creation, and turnover, by demography, geography, and industry for each state.
- *Synthetic Longitudinal Business Database (SynLBD)*. Experimental synthetic microdata on all U.S. establishments including employment, payroll, and age.
- *Veteran Employment Outcomes (VEO)*. Statistics on the earnings and employment outcomes of U.S. Army veterans, by demographic, service, and employer characteristics.

HISTORY

CES was established in 1982 to house databases on businesses, link them cross-sectionally and longitudinally, conduct economic research with them, and make

them available to researchers. In his 1991 Nobel Prize lecture, economist Ronald Coase noted, “We can also hope to learn much more in the future from the studies of the activities of firms which have recently been initiated by the Center for Economic Studies of the Bureau of the Census of the United States.”

Elaborating on these thoughts in a letter sent to CES following a visit there in June 1993, Coase states:

“It must be a matter of pride for all in the Bureau of the Census to have a unit which, through its research activities, is playing such a valuable role in increasing our understanding of the working of our economic system. Of course, no individual or institution can do everything. The Center will have to depend on research conducted elsewhere (particularly in universities) . . . to develop a more complete and more accurate picture of the structure of the economy. For this reason I greatly welcome the initiative of the Bureau of the Census in establishing an office of the Center in Boston . . . and I hope, after assessing your experience in Boston, that it will be found desirable to establish similar offices in other places.”

Indeed, CES opened the first research data center in Boston in 1994 and continued to grow the network over the next quarter century. Today, there are FSRDCs located at dozens of universities and research organizations across the country. In addition to restricted-use data on businesses and households

from the Census Bureau, the FSRDCs now also provide secure access to restricted-use data from other federal statistical agencies. As of 2018, the FSRDCs are administered by the newly established Center for Enterprise Dissemination.

With time, CES’ focus evolved from a near-exclusive focus on the manufacturing sector to include nonmanufacturing sectors and data on workers and households. In 2008, the Longitudinal Employer-Household Dynamics (LEHD) program joined CES from the Census Bureau’s Demographic Directorate, and in 2018, researchers from the former Center for Administrative Records Research and Applications (CARRA) joined CES.

Today, CES is comprised of several dozen researchers with doctorates in economics, sociology, demography, public policy, statistics, and history and with research that is even more diverse.

PARTNERSHIPS

CES relies on many partners within and outside the Census Bureau, including:

- Census Bureau divisions that collect, process, and produce the business and household microdata at the heart of our research and that provide us their expert knowledge of the methodologies underlying those surveys and censuses.
- Our colleagues in other centers within the Research and Methodology Directorate.

- Those with whom we are collaborating on joint research and development, including:
 - Fellow statistical agencies including the Bureau of Economic Analysis, Bureau of Justice Statistics, Bureau of Labor Statistics, Economic Research Service, National Center for Health Statistics, and National Center for Science and Engineering Statistics.
 - Other federal agencies including the Agency for Healthcare Research and Quality, Food and Nutrition Service, National Institutes of Health (National Cancer Institute; National Heart, Lung, and Blood Institute; National Institute on Aging), and the Small Business Administration.
 - Academic institutions including Brown University, Harvard University, University of California—Irvine, University of Maryland, and University of North Carolina at Chapel Hill.
 - Other research organizations including the Institute for Research on Innovation and Science, NORC at the University of Chicago, and the RAND Corporation.
- The members of the Local Employment Dynamics Partnership and other LEHD partners (Appendix 5), who provide data critical to a number of our public-use data products, including *J2J*, *OnTheMap*, *PSEO*, *VEO*, and the *QWI*.

Appendix 2.

PUBLICATIONS AND WORKING PAPERS BY CENTER FOR ECONOMIC STUDIES STAFF: 2020

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- Abraham, Katharine G., John C. Haltiwanger, Claire Hou, Kristin Sandusky, and James R. Spletzer, "Reconciling Survey and Administrative Measures of Self-Employment," *Journal of Labor Economics*, forthcoming.
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Appendix 3.

ABSTRACTS OF CENTER FOR ECONOMIC STUDIES WORKING PAPERS BY CENSUS BUREAU STAFF: 2020

Center for Economic Studies Working Paper 20-01

RISING IMPORT TARIFFS, FALLING EXPORT GROWTH: WHEN MODERN SUPPLY CHAINS MEET OLD-STYLE PROTECTIONISM

Kyle Handley
Fariha Kamal
Ryan Monarch

January 2020

We examine the impacts of the 2018–2019 U.S. import tariff increases on U.S. export growth through the lens of supply chain linkages. Using 2016 confidential firm-trade linked data, we document the implied incidence and scope of new import tariffs. Firms that eventually faced tariff increases on their imports accounted for 84 percent of all exports and represented 65 percent of manufacturing employment. For all affected firms, the implied cost is \$900 per worker in new duties.

To estimate the effect on U.S. export growth, we construct product-level measures of import tariff exposure of U.S. exports from the underlying firm micro data. More exposed products experienced 2 percentage points lower growth relative to products with no exposure. The decline in exports is equivalent to an ad valorem tariff on U.S. exports of almost 2 percent for the typical product and almost 4 percent for products with higher than average exposure.

Center for Economic Studies Working Paper 20-02

WHAT CAUSED RACIAL DISPARITIES IN PARTICULATE EXPOSURE TO FALL? NEW EVIDENCE FROM THE CLEAN AIR ACT AND SATELLITE-BASED MEASURES OF AIR QUALITY

Janet Currie
John Voorheis
Reed Walker

January 2020

Racial differences in exposure to ambient air pollution have declined significantly in the United States over the past 20 years. This project links restricted-access U.S. Census Bureau microdata to newly available, spatially continuous, high-resolution measures of ambient particulate pollution (PM_{2.5}) to examine the underlying causes and consequences of differences in Black-White pollution exposures. We begin by decomposing differences in pollution exposure into components explained by observable population characteristics (e.g., income) versus

those that remain unexplained. We then use quantile regression methods to show that a significant portion of the “unexplained” convergence in Black-White pollution exposure can be attributed to differential impacts of the Clean Air Act (CAA) in non-Hispanic African American and non-Hispanic White communities. Areas with larger Black populations saw greater CAA-related declines in PM_{2.5} exposure. We show that the CAA has been the single largest contributor to racial convergence in PM_{2.5} pollution exposure in the United States since 2000, accounting for over 60 percent of the reduction.

MATCHING STATE BUSINESS REGISTRATION RECORDS TO CENSUS BUSINESS DATA

J. Daniel Kim
Kristin McCue

January 2020

We describe our methodology and results from matching state Business Registration Records (BRR) to Census business data. We use data from Massachusetts and California to develop methods and preliminary results that could be used to guide matching data for additional states. We obtain matches to Census business records for 45 percent of the Massachusetts BRR records and 40 percent of the California BRR records. We find higher match rates for incorporated businesses and businesses with higher startup-quality scores as assigned in Guzman and Stern (2018). Clerical reviews show that using relatively strict matching on address is important for match accuracy, while

results are less sensitive to name matching strictness. Among matched BRR records, the modal timing of the first match to the Business Register (BR) is in the year in which the BRR record was filed. We use two sets of software to identify matches: SAS DQ Match and a machine-learning (ML) algorithm described in Cuffe and Goldschlag (2018). We find preliminary evidence that while the ML-based method yields more match results, SAS DQ tends to result in higher accuracy rates. To conclude, we provide suggestions on how to proceed with matching other states' data in light of our findings using these two states.

DO CASH WINDFALLS AFFECT WAGES? EVIDENCE FROM R&D GRANTS TO SMALL FIRMS

Sabrina T. Howell
J. David Brown

February 2020

This paper examines how employee earnings at small firms respond to a cash flow shock in the form of a government R&D grant. We use ranking data on applicant firms, which we link to IRS W-2 earnings and other U.S. Census Bureau datasets. In a regression discontinuity design, we find that the grant increases average earnings with a rent-sharing elasticity of 0.07 (0.21) at the employee (firm) level. The beneficiaries are incumbent employees who were present at the firm before

the award. Among incumbent employees, the effect increases with worker tenure. The grant also leads to higher employment and revenue, but productivity growth cannot fully explain the immediate effect on earnings. Instead, the data and a grantee survey are consistent with a back-loaded wage contract channel, in which employees of financially constrained firms initially accept relatively low wages and are paid more when cash is available.

**BETWEEN FIRM CHANGES IN EARNINGS INEQUALITY:
THE DOMINANT ROLE OF INDUSTRY EFFECTS**

John Haltiwanger
James R. Spletzer

February 2020

We find that most of the rising between firm earnings inequality that dominates the overall increase in inequality in the United States is accounted for by industry effects. These industry effects stem from rising interindustry earnings differentials and not from changing distribution of employment across industries. We also find the rising

interindustry earnings differentials are almost completely accounted for by occupation effects. These results link together the key findings from separate components of the recent literature: one focuses on firm effects and the other on occupation effects. The link via industry effects challenges conventional wisdom.

**ARE CUSTOMS RECORDS CONSISTENT ACROSS COUNTRIES?
EVIDENCE FROM THE U.S. AND COLOMBIA**

C.J. Krizan
James Tybout
Zi Wang
Yingyan Zhao

March 2020

In many countries, official customs records include identifying information on the exporting and importing firms involved in each shipment. This information allows researchers to study international business networks, offshoring patterns, and the microfoundations of aggregate trade flows. It also provides the government with a basis for tariff assessments at the border. However, there are no mechanisms in place to ensure that the shipment-level information

recorded by the exporting country is consistent with the shipment-level information recorded by the importing country. And to the extent that there are discrepancies, it is not clear how prevalent they are or what form they take. In this paper, we explore these issues, both to enhance our understanding of the limitations of customs records and to inform future discussions of possible revisions in the way they are collected.

**RECALL AND RESPONSE: RELATIONSHIP ADJUSTMENTS
TO ADVERSE INFORMATION SHOCKS**

Emek Basker
Fariha Kamal

March 2020

How resilient are buyer-supplier relationships to new information about product defects? We construct a novel dataset of U.S. consumer product recalls sourced from foreign suppliers between 1995 and 2013. Using an event-study approach, we find that compared to control relationships, buyers that experience recalls temporarily reduce their probability of trading with the suppliers of the

recalled products by 25 percent. A milder decrease persists, accompanied by increased reliance on other foreign suppliers. Buyers that are affiliated with their suppliers decrease trade several quarters earlier than unaffiliated buyers, consistent with decision-making and information flowing faster within than across firm boundaries.

EARNINGS GROWTH, JOB FLOWS AND CHURN

Satoshi Tanaka
Lawrence Warren
David Wiczer

April 2020

How much do workers making job-to-job transitions benefit from moving away from a shrinking and towards a growing firm? We show that earnings growth in the transition increases with net employment growth at the destination firm and, to a lesser extent, decreases if the origin firm is shrinking. So, we sum the effect of leaving a shrinking and entering a growing firm and remove

the excess turnover-related hires because gross hiring has a much smaller association with earnings growth than net employment growth. We find that job-to-job transitions with the cross-firm job flow have 23 percent more earnings growth than average.

**MEASURING THE EFFECT OF COVID-19 ON U.S. SMALL BUSINESSES:
THE SMALL BUSINESS PULSE SURVEY**

Catherine Buffington
Carrie Dennis
Emin Dinlersoz
Lucia Foster
Shawn Klimek

May 2020

In response to the novel coronavirus (COVID-19) pandemic, the U.S. Census Bureau developed and fielded an entirely new survey intended to measure the effect on small businesses. The Small Business Pulse Survey (SBPS) will run weekly from April 26 to June 27, 2020. Results from the SBPS will be published weekly through a visualization tool with downloadable data. We describe the motivation for SBPS, summarize how the content for the survey was developed, and discuss some of the initial results from the survey. We also describe

future plans for the SBPS collections and for our research using the SBPS data. Estimates from the first week of the SBPS indicate large to moderate negative effects of COVID-19 on small businesses, and yet the majority expect to return to usual level of operations within the next 6 months. Reflecting the Census Bureau's commitment to scientific inquiry and transparency, the micro data from the SBPS will be available to qualified researchers on approved projects in the federal statistical research data center network.

THE IMPACT OF 2010 DECENNIAL CENSUS HIRING ON THE UNEMPLOYMENT RATE

Jonathan Eggleston
Mark Klee
Kristin McCue
Kristin Sandusky
Jim Spletzer

June 2020

The decennial census is the largest peacetime operation of the U.S. federal government. The U.S. Census Bureau hires hundreds of thousands of temporary workers to conduct the decennial census. The magnitude of this temporary workforce influences the national employment situation when enumeration efforts ramp up and when they recede. The impact of decennial census hiring on the headline number of payroll jobs added each month is well established, but previous work has not established how decennial census hiring affects the headline unemployment rate. We link the 2010 Decennial Applicant Personnel and Payroll System data to the 2010 American Community Survey to answer this question. We find that the large hiring surge in May 2010 came

mostly from people already employed (40 percent) or from people who were unemployed (33 percent). We estimate that the workers hired for the 2010 Census lowered the May 2010 unemployment rate by one-tenth of a percentage point relative to the counterfactual. This one-tenth of a percentage point is within the standard error for the official unemployment rate, and Bureau of Labor Statistics press releases would denote a change in the unemployment rate of 0.1 percent or less as "unchanged." We also estimate that relative to the counterfactual, the more gradual changes in decennial census employment influenced the unemployment rate by less than one-tenth of a percentage point in every other month during 2010.

ESTIMATING THE IMMEDIATE IMPACT OF THE COVID-19 SHOCK ON PARENTAL ATTACHMENT TO THE LABOR MARKET AND THE DOUBLE BIND OF MOTHERS

Misty L. Heggeness

July 2020

I examine the impact of the COVID-19 shock on parents' labor supply during the initial stages of the pandemic. Using difference-in-difference estimation and monthly panel data from the Current Population Survey (CPS), I compare labor market attachment, nonwork activity, hours worked, and earnings and wages of those in areas with early school closures and stay-in-place orders with those in areas with delayed or no pandemic closures. While there was no immediate impact on detachment or unemployment, mothers with jobs in early closure states were 68.8 percent more likely than mothers in late closure states to have a job but not be working as a result of early shutdowns. There was no effect on working

fathers or working women without school-age children. Mothers who continued working increased their work hours relative to comparable fathers; this effect, however, appears entirely driven by a reduction in fathers' hours worked. Overall, the pandemic appears to have induced a unique immediate juggling act for working parents of school-age children. Mothers took a week of leave from formal work; fathers working full-time, for example, reduced their hours worked by 0.53 hours over the week. While experiences were different for mothers and fathers, each are vulnerable to scarring and stunted opportunities for career growth and advancement due to the pandemic.

WHO VALUES HUMAN CAPITALISTS' HUMAN CAPITAL? HEALTHCARE SPENDING AND PHYSICIAN EARNINGS

Joshua D. Gottlieb

Maria Polyakova

Kevin Rinz

Hugh Shiplett

Victoria Udalova

July 2020

Is government guiding the invisible hand at the top of the labor market? We study this question among physicians, the most common occupation among the top one percent of income earners, and whose billings comprise one-fifth of healthcare spending. We use a novel linkage of population-wide tax records with the administrative registry of all physicians in the United States to study the characteristics of these high earnings and the influence of government payments in particular. We find a major role for government on the margin, with half of direct changes to government reimbursement rates owing directly into physicians'

incomes. These policies move physicians' relative and absolute incomes more than any reasonable changes to marginal tax rates. At the same time, the overall level of physician earnings can largely be explained by labor market fundamentals of long work and training hours. Competing occupations also pay well and provide a natural lower bound for physician earnings. We conclude that government plays a major role in determining the value of physicians' human capital, but it is unrealistic to use this power to reduce healthcare spending substantially.

TRENDS IN EARNINGS VOLATILITY USING LINKED ADMINISTRATIVE AND SURVEY DATA

James P. Ziliak
Charles Hokayem
Christopher R. Bollinger

August 2020

We document trends in earnings volatility separately by gender in combination with other characteristics, such as race, educational attainment, and employment status, using unique linked survey and administrative data for the tax years spanning 1995–2015. We also decompose the variance of trend volatility into within- and between-group contributions, as well as transitory and permanent shocks. Our results for continuously working men suggest that trend earnings volatility was stable over our period in both survey and tax data, though with a substantial countercyclical business-cycle component. Trend earnings volatility among

women declined over the period in both survey and administrative data, but unlike for men, there was no change over the Great Recession. The variance decompositions indicate that nonresponders, low-educated, racial minorities, and part-year workers have the greatest group specific earnings volatility, but with the exception of part-year workers, they contribute least to the level and trend of volatility owing to their small share of the population. There is evidence of stable transitory volatility, but rising permanent volatility over the past two decades in male and female earnings.

**FAMILY-LEAVE MANDATES AND FEMALE LABOR AT U.S. FIRMS:
EVIDENCE FROM A TRADE SHOCK**

Fariha Kamal
Asha Sundaram
Cristina J. Tello-Trillo

September 2020

We study the role of family-leave mandates in shaping the gender composition at U.S. firms that experience a negative demand shock. In a regression discontinuity framework, we compare firms mandated to provide job-protected leave under the Family and Medical Leave Act (FMLA) and firms that are exempt from the law (non-FMLA) following the post-2001 surge in Chinese imports. Using confidential microdata on matched employers and employees in the U.S. nonfarm private sector, we find that between 2000 and 2003,

an increase in import competition decreases the share of female workers at FMLA compared to non-FMLA firms. The negative differential effect is driven by female workers in prime childbearing years, with less than college education and is strongest at firms with all male managers. We find similar patterns in changes in the female share of earnings and promotions. These results are consistent with the presence of traditional gender norms that assign primary caregiving responsibilities at home to women.

A NEW MEASURE OF MULTIPLE JOBHOLDING IN THE U.S. ECONOMY

Keith A. Bailey
James R. Spletzer

September 2020

We create a measure of multiple jobholding from the U.S. Census Bureau's Longitudinal Employer-Household Dynamics data. This new series shows that 7.8 percent of persons in the United States are multiple jobholders, this percentage is procyclical, and has been trending upward during the past 20 years. The data also show that earnings from secondary jobs are, on average, 27.8 percent

of a multiple jobholder's total quarterly earnings. Multiple jobholding occurs at all levels of earnings, with both higher- and lower-earnings multiple jobholders earning more than 25 percent of their total earnings from multiple jobs. These new statistics tell us that multiple jobholding is more important in the U.S. economy than we knew.

A SHORE THING: POST-HURRICANE OUTCOMES FOR BUSINESSES IN COASTAL AREAS

Melissa Chow
Jordan Stanley

September 2020

During the twenty-first century, hurricanes, heavy storms, and flooding have affected many areas in the United States. Natural disasters and climate change can cause property damage and could have an impact on a variety of business outcomes. This paper builds upon existing research and literature that analyzes the impact of natural disasters on businesses. Specifically, we look at the differential effect of eight hurricanes during the period

2000–2009 on establishments in coastal counties relative to establishments in coastal-adjacent or inland counties. Our outcomes of interest include establishment employment and death. We find that following a hurricane event, establishments located in a coastal county have lower employment and increased probability of death relative to establishments in noncoastal counties.

**IDENTIFYING U.S. MERCHANDISE TRADERS: INTEGRATING CUSTOMS
TRANSACTIONS WITH BUSINESS ADMINISTRATIVE DATA**

Fariha Kamal
Wei Ouyang

September 2020

This paper describes the construction of the Longitudinal Firm Trade Transactions Database (LFTTD) enabling the identification of merchandise traders—exporters and importers—in the U.S. Census Bureau’s Business Register (BR). The LFTTD links merchandise export and import transactions from customs declaration forms to the BR beginning in 1992 through the present. We employ a combination of deterministic and probabilistic matching algorithms to assign a unique firm identifier in the BR to a merchandise export or import

transaction record. On average, we match 89 percent of export and import values to a firm identifier. In 1992, we match 79 (88) percent of export (import) value; in 2017, we match 92 (96) percent of export (import) value. Trade transactions in year t are matched to years between 1976 and $t+1$ of the BR. On average, 94 percent of the trade value matches to a firm in year t of the BR. The LFTTD provides the most comprehensive identification of and the foundation for the analysis of goods trading firms in the U.S. economy.

UNITED STATES EARNINGS DYNAMICS: INEQUALITY, MOBILITY, AND VOLATILITY

Kevin L. McKinney
John M. Abowd
John Sabelhaus

September 2020

Using data from the U.S. Census Bureau’s Longitudinal Employer-Household Dynamics (LEHD) infrastructure files, we study changes over time and across subnational populations in the distribution of real labor earnings. We consider four large metropolitan statistical areas (MSAs) (Detroit, Los Angeles, New York, and San Francisco) for the period 1998 to 2017, with particular attention paid to the subperiods before, during, and after the Great Recession. For the four large MSAs we analyze, there are clear national trends represented in each of the local areas, the most prominent of which is the increase in the share of earnings accruing to workers at the top

of the earnings distribution in 2017 compared with 1998. However, the magnitude of these trends varies across MSAs, with New York and San Francisco showing relatively large increases and Los Angeles somewhere in the middle relative to Detroit whose total real earnings distribution is relatively stable over the period. Our results contribute to the emerging literature on differences between national and regional economic outcomes, exemplifying what will be possible with a new data exploration tool—the Earnings and Mobility Statistics (EAMS) Web application—currently under development at the Census Bureau.

TOTAL ERROR AND VARIABILITY MEASURES FOR THE QUARTERLY WORKFORCE INDICATORS AND LEHD ORIGIN DESTINATION EMPLOYMENT STATISTICS IN ONTHEMAP

Kevin L. McKinney

Andrew S. Green

Lars Vilhuber

John M. Abowd

September 2020

We report results from the first comprehensive total quality evaluation of five major indicators in the U.S. Census Bureau's Longitudinal Employer-Household Dynamics (LEHD) Program Quarterly Workforce Indicators (QWI): total flow-employment, beginning-of-quarter employment, full-quarter employment, average monthly earnings of full-quarter employees, and total quarterly payroll. Beginning-of-quarter employment is also the main tabulation variable in the LEHD Origin-Destination Employment Statistics (LODES) workplace reports as displayed in OnTheMap (OTM), including OnTheMap for Emergency Management. We account for errors due to coverage; record-level

nonresponse; edit and imputation of item missing data; and statistical disclosure limitation. The analysis reveals that the five publication variables under study are estimated very accurately for tabulations involving at least 10 jobs. Tabulations involving three to nine jobs are a transition zone, where cells may be fit for use with caution. Tabulations involving one or two jobs, which are generally suppressed on fitness-for-use criteria in the QWI and synthesized in LODES, have substantial total variability but can still be used to estimate statistics for untabulated aggregates as long as the job count in the aggregate is more than 10.

MALE EARNINGS VOLATILITY IN LEHD BEFORE, DURING, AND AFTER THE GREAT RECESSION

Kevin L. McKinney

John M. Abowd

September 2020

This paper is part of a coordinated collection of papers on prime-age male earnings volatility. Each paper produces a similar set of statistics for the same reference population using a different primary data source. Our primary data source is the U.S. Census Bureau's Longitudinal Employer Household Dynamics (LEHD) infrastructure files. Using LEHD data from 1998 to 2016, we create a well-defined population frame to facilitate accurate estimation of temporal changes comparable to designed longitudinal samples of people. We show that earnings volatility, excluding increases during recessions, has declined over the analysis period, a finding robust to various sensitivity analyses. Although we find volatility is declining, the effect is not homogeneous, particularly for workers with

tenuous labor force attachment for whom volatility is increasing. These "not stable" workers have earnings volatility approximately 30 times larger than stable workers, but more important for earnings volatility trends we observe a large increase in the share of stable employment from 60 percent in 1998 to 67 percent in 2016, which we show to largely be responsible for the decline in overall earnings volatility. To further emphasize the importance of not stable and/or low earning workers we also conduct comparisons with the Panel Study of Income Dynamics (PSID) and show how changes over time in the share of workers at the bottom tail of the cross-sectional earnings distributions can produce either declining or increasing earnings volatility trends.

**DETERMINATION OF THE 2020 U.S. CITIZEN VOTING-AGE POPULATION (CVAP) USING
ADMINISTRATIVE RECORDS AND STATISTICAL METHODOLOGY TECHNICAL REPORT**

John M. Abowd
William R. Bell
J. David Brown
Michael B. Hawes
Misty L. Heggeness
Andrew D. Keller
Vincent T. Mule, Jr.
Joseph L. Schafer
Matthew Spence
Lawrence Warren
Moises Yi

October 2020

This report documents the efforts of the U.S. Census Bureau's Citizen Voting-Age Population (CVAP) Internal Expert Panel (IEP) and Technical Working Group (TWG) toward the use of multiple data sources to produce block-level statistics on the citizen voting-age population for use in enforcing the Voting Rights Act. It describes the administrative,

survey, and census data sources used, and the four approaches developed for combining these data to produce CVAP estimates. It also discusses other aspects of the estimation process, including how records were linked across the multiple data sources and the measures taken to protect the confidentiality of the data.

**AN EVALUATION OF THE GENDER WAGE GAP USING LINKED SURVEY AND
ADMINISTRATIVE DATA**

Thomas B. Foster
Marta Murray-Close
Liana Christin Landivar
Mark deWolf

November 2020

The narrowing of the gender wage gap has slowed in recent decades. However, current estimates show that, among full-time, year-round workers, women earn approximately 18 to 20 percent less than men at the median. Women's human capital and labor force characteristics that drive wages increasingly resemble men's, so remaining differences in these characteristics explain less of the gender wage gap now than in the past. As these factors wane in importance, studies show that others like occupational and industrial segregation explain larger portions of the gender wage gap. However, a major limitation of these studies is that the large datasets required to analyze occupation and industry effectively lack measures of labor force experience. This study combines survey and administrative data to analyze and improve estimates of the gender wage gap within

detailed occupations, while also accounting for gender differences in work experience. We find a gender wage gap of 18 percent among full-time, year-round workers across 316 detailed occupation categories. We show the wage gap varies significantly by occupation: while wages are at parity in some occupations, gaps are as large as 45 percent in others. More competitive and hazardous occupations, occupations that reward longer hours of work, and those that have a larger proportion of women workers have larger gender wage gaps. The models explain less of the wage gap in occupations with these attributes. Occupational characteristics shape the conditions under which men and women work and we show these characteristics can make for environments that are more or less conducive to gender parity in earnings.

THE EITC AND INTERGENERATIONAL MOBILITY

Maggie R. Jones
Emilia Simeonova
Randall Akee

November 2020

We study how the largest federal tax-based policy intended to promote work and increase incomes among the poor—the Earned Income Tax Credit (EITC)—affects the socioeconomic standing of children who grew up in households affected by the policy. Using the universe of tax filer records for children linked to their parents, matched with demographic and household information from the decennial census and American Community Survey data, we exploit exogenous differences by children’s ages in the births and “aging out” of siblings to assess the effect of EITC generosity on child outcomes. We focus on assessing mobility in the child income distribution, conditional on the parents’ position in the parental income distribution. Our findings suggest significant and mostly positive effects of more generous EITC refunds on the next generation that vary substantially depending on the child’s household type (single-mother or married family) and by the child’s gender. All

children, except White children from single-mother households, experience increases in cohort-specific income rank, own family income, and the probability of working at the ages of 25–26 in response to greater EITC generosity. Children from married households show a considerably stronger response on these measures than do children from single-mother households. Because of the concentration of family types within race groups, the more positive response among children from married households suggests the EITC might lead to higher within-generation racial income inequality. Finally, we examine how the impact of EITC generosity varies by the age at which children are exposed to higher benefits. These results suggest that children who first receive the more generous two-child treatment at later ages have a stronger positive response in terms of rank and family income than children exposed at younger ages.

THE GRANDKIDS AREN’T ALRIGHT: THE INTERGENERATIONAL EFFECTS OF PRENATAL POLLUTION EXPOSURE

Jonathan Colmer
John Voorheis

November 2020

Evidence shows that environmental quality shapes human capital at birth with long-run effects on health and welfare. Do these effects, in turn, affect the economic opportunities of future generations? Using newly linked survey and administrative data, providing more than 150 million parent-child links, we show that regulation-induced improvements in air quality that an individual experienced in the womb increase the likelihood that their children, the second

generation, attend college 40 to 50 years later. Intergenerational transmission appears to arise from greater parental resources and investments, rather than heritable, biological channels. Our findings suggest that within-generation estimates of marginal damages substantially underestimate the total welfare effects of improving environmental quality and point to the empirical relevance of environmental quality as a contributor to economic opportunity in the United States.

TWISTING THE DEMAND CURVE: DIGITALIZATION AND THE OLDER WORKFORCE

Erling Barth
James C. Davis
Richard B. Freeman
Kristina McElheran

November 2020

This paper uses U.S. Census Bureau panel data that link firm software investment to worker earnings. We regress the log of earnings of workers by age group on the software investment by their employing firm. To unpack the potential causal factors for differential software effects by age group, we extend the Abowd-Kramarz-Margolis (AKM) framework by including job-spell fixed effects that allow for a correlation between the worker-firm match and age and by including time-varying firm effects that allow for a correlation between wage-enhancing productivity shocks and software investments. Within job-spell, software

capital raises earnings at a rate that declines post age 50 to about zero after age 65. By contrast, the effects of non-IT equipment investment on earnings increase for workers post age 50. The difference between the software and non-IT equipment effects suggests that our results are attributable to the technology rather than to age-related bargaining power. Our data further show that software capital increases the earnings of high-wage workers relative to low-wage workers and the earnings in high-wage firms relative to low-wage firms and may, thus, widen earnings inequality within and across firms.

ADVANCED TECHNOLOGIES ADOPTION AND USE BY U.S. FIRMS: EVIDENCE FROM THE ANNUAL BUSINESS SURVEY

Nikolas Zolas
Zachary Kroff
Erik Brynjolfsson
Kristina McElheran
David Beede
Catherine Buffington
Nathan Goldschlag

December 2020

We introduce a new survey module intended to complement and expand research on the causes and consequences of advanced technology adoption. The 2018 Annual Business Survey (ABS), conducted by the U.S. Census Bureau in partnership with the National Center for Science and Engineering Statistics (NCSES), provides comprehensive and timely information on the diffusion among U.S. firms of advanced technologies including artificial intelligence (AI), cloud computing, robotics, and the digitization of business information. The 2018 ABS is a large, nationally representative sample of over 850,000 firms covering all private, nonfarm sectors of the economy. We describe the motivation for and development of the technology module in the ABS, as well as

provide a first look at technology adoption and use patterns across firms and sectors. We find that digitization is quite widespread, as is some use of cloud computing. In contrast, advanced technology adoption is rare and generally skewed towards larger and older firms. Adoption patterns are consistent with a hierarchy of increasing technological sophistication, in which most firms that adopt AI or other advanced business technologies also use the other, more widely diffused technologies. Finally, while few firms are at the technology frontier, they tend to be large so technology exposure of the average worker is significantly higher. This new data will be available to qualified researchers on approved projects in the federal statistical research data center (FSRDC) network.

BUSINESS-LEVEL EXPECTATIONS AND UNCERTAINTY

Nicholas Bloom
Steven J. Davis
Lucia Foster
Brian Lucking
Scott Ohlmacher
Itay Saporta-Eksten

December 2020

The U.S. Census Bureau's 2015 Management and Organizational Practices Survey (MOPS) utilized innovative methodology to collect five-point forecast distributions over own future shipments, employment, and capital and materials expenditures for 35,000 U.S. manufacturing plants. First and second moments of these plant-level forecast distributions covary strongly with first and second moments, respectively, of historical outcomes. The first moment of the distribution provides a measure of business' expectations for future outcomes, while the second moment provides a measure of business' subjective uncertainty over those outcomes. This subjective uncertainty measure correlates positively with financial risk measures. Drawing on the Annual Survey of Manufactures and the Census of Manufactures

for the corresponding realizations, we find that subjective expectations are highly predictive of actual outcomes and, in fact, more predictive than statistical models fit to historical data. When respondents express greater subjective uncertainty about future outcomes at their plants, their forecasts are less accurate. However, managers supply overly precise forecast distributions in that implied confidence intervals for sales growth rates are much narrower than the distribution of actual outcomes. Finally, we develop evidence that greater use of predictive computing and structured management practices at the plant and a more decentralized decision-making process (across plants in the same firm) are associated with better forecast accuracy.

IMMIGRATION AND ENTREPRENEURSHIP IN THE UNITED STATES

Pierre Azoulay
Benjamin F. Jones
J. Daniel Kim
Javier Miranda

December 2020

Immigrants can expand labor supply and compete for jobs with native-born workers. But immigrants may also start new firms, expanding labor demand. This paper uses U.S. administrative data and other data sources to study the role of immigrants in entrepreneurship. We ask how often immigrants start companies, how many jobs these firms create, and how firms founded by

native-born individuals compare. A simple model provides a measurement framework for addressing the dual roles of immigrants as founders and workers. The findings suggest that immigrants act more as "job creators" than "job takers" and play outsized roles in U.S. high-growth entrepreneurship.

Appendix 4.

CENTER FOR ECONOMIC STUDIES WORKING PAPERS: 2020

CES Working Papers are available at <www.census.gov/programs-surveys/ces/research/ces-discussion-paper-series.html>.

20-01	"Rising Import Tariffs, Falling Export Growth: When Modern Supply Chains Meet Old-Style Protectionism," by Kyle Handley, Fariha Kamal, and Ryan Monarch, January 2020.	20-10	"Do Short-Term Incentives Affect Long-Term Productivity?" by Heitor Almeida, Nuri Ersahin, Vyacheslav Fos, Rustom M. Irani, and Mathias Kronlund, March 2020.
20-02	"What Caused Racial Disparities in Particulate Exposure to Fall? New Evidence From the Clean Air Act and Satellite-Based Measures of Air Quality," by Janet Currie, John Voorheis, and Reed Walker, January 2020.	20-11	"Are Customs Records Consistent Across Countries? Evidence From the U.S. and Colombia," by C.J. Krizan, James Tybout, Zi Wang, and Yingyan Zhao, March 2020.
20-03	"Matching State Business Registration Records to Census Business Data," by J. Daniel Kim and Kristin McCue, January 2020.	20-12	"The Micro-Level Anatomy of the Labor Share Decline," by Matthias Kehrig and Nicolas Vincent, March 2020.
20-04	"Housing Booms and the U.S. Productivity Puzzle," by Jose Carreno, January 2020.	20-13	"Recall and Response: Relationship Adjustments to Adverse Information Shocks," by Emek Basker and Fariha Kamal, March 2020.
20-05	"Validating Abstract Representations of Spatial Population Data While Considering Disclosure Avoidance," by James Gaboardi, February 2020.	20-14	"R&D or R vs. D? Firm Innovation Strategy and Equity Ownership," by James Driver, Adam Kolasinski, and Jared Stanfield, April 2020.
20-06	"Do Cash Windfalls Affect Wages? Evidence From R&D Grants to Small Firms," by Sabrina T. Howell and J. David Brown, February 2020.	20-15	"Earnings Growth, Job Flows and Churn," by Satoshi Tanaka, Lawrence Warren, and David Wiczer, April 2020.
20-07	"Misallocation or Mismeasurement?" by Mark Bils, Peter J. Klenow, and Cian Ruane, February 2020.	20-16	"Measuring the Effect of COVID-19 on U.S. Small Businesses: The Small Business Pulse Survey," by Catherine Buffington, Carrie Dennis, Emin Dinlersoz, Lucia Foster, and Shawn Klimek, May 2020.
20-08	"Between Firm Changes in Earnings Inequality: The Dominant Role of Industry Effects," by John Haltiwanger and James R. Spletzer, February 2020.	20-17	"Does Goliath Help David? Anchor Firms and Startup Clusters," by Rahul R. Gupta, May 2020.
20-09	"Compositional Nature of Firm Growth and Aggregate Fluctuations," by Vladimir Smirnyagin, March 2020.	20-18	"The Energy Efficiency Gap and Energy Price Responsiveness in Food Processing," by Gale Boyd and Matt Doolin, June 2020.

20-19	“The Impact of 2010 Decennial Census Hiring on the Unemployment Rate,” by Jonathan Eggleston, Mark Klee, Kristin McCue, Kristin Sandusky, and Jim Spletzer, June 2020.	20-27	“A Shore Thing: Post-Hurricane Outcomes for Businesses in Coastal Areas,” by Melissa Chow and Jordan Stanley, September 2020.
20-20	“The Disappearing IPO Puzzle: New Insights From Proprietary U.S. Census Data on Private Firms,” by Thomas Chemmanur, Jie (Jack) He, Xiao (Shaun) Ren, and Tao Shu, June 2020.	20-28	“Identifying U.S. Merchandise Traders: Integrating Customs Transactions With Business Administrative Data,” by Fariha Kamal and Wei Ouyang, September 2020.
20-21	“How Does State-Level Carbon Pricing in the United States Affect Industrial Competitiveness?” by Brendan Casey, Wayne B. Gray, Joshua Linn, and Richard D. Morgenstern, June 2020.	20-29	“United States Earnings Dynamics: Inequality, Mobility, and Volatility,” by Kevin L. McKinney, John M. Abowd, and John Sabelhaus, September 2020.
20-22	“Estimating the Immediate Impact of the COVID-19 Shock on Parental Attachment to the Labor Market and the Double Bind of Mothers,” by Misty L. Heggeness, July 2020.	20-30	“Total Error and Variability Measures for the Quarterly Workforce Indicators and LEHD Origin Destination Employment Statistics in OnTheMap,” by Kevin L. McKinney, Andrew S. Green, Lars Vilhuber, and John M. Abowd, September 2020.
20-23	“Who Values Human Capitalists’ Human Capital? Healthcare Spending and Physician Earnings,” by Joshua D. Gottlieb, Maria Polyakova, Kevin Rinz, Hugh Shiple, and Victoria Udalova, July 2020.	20-31	“Male Earnings Volatility in LEHD Before, During, and After the Great Recession,” by Kevin L. McKinney and John M. Abowd, September 2020.
20-24	“Trends in Earnings Volatility Using Linked Administrative and Survey Data,” by James P. Ziliak, Charles Hokayem, and Christopher R. Bollinger, August 2020.	20-32	“Home Equity Lending, Credit Constraints and Small Business in the US,” by William D. Lastrapes, Ian Schmutte, and Thor Watson, October 2020.
20-25	“Family-Leave Mandates and Female Labor at U.S. Firms: Evidence From a Trade Shock,” by Fariha Kamal, Asha Sundaram, and Cristina J. Tello-Trillo, September 2020.	20-33	“Determination of the 2020 U.S. Citizen Voting Age Population (CVAP) Using Administrative Records and Statistical Methodology Technical Report,” by John M. Abowd, William R. Bell, J. David Brown, Michael B. Hawes, Misty L. Heggeness, Andrew D. Keller, Vincent T. Mule Jr., Joseph L. Schafer, Matthew Spence, Lawrence Warren, and Moises Yi, October 2020.
20-26	“A New Measure of Multiple Jobholding in the U.S. Economy,” by Keith A. Bailey and James R. Spletzer, September 2020.		

20-34	“An Evaluation of the Gender Wage Gap Using Linked Survey and Administrative Data,” by Thomas B. Foster, Marta Murray-Close, Liana Christin Landivar, and Mark deWolf, November 2020.	20-40	“Advanced Technologies Adoption and Use by U.S. Firms: Evidence From the Annual Business Survey,” by Nikolas Zolas, Zachary Kroff, Erik Brynjolfsson, Kristina McElheran, David Beede, Catherine Buffington, Nathan Goldschlag, Lucia Foster, and Emin Dinlersoz, December 2020.
20-35	“The EITC and Intergenerational Mobility,” by Maggie R. Jones, Emilia Simeonova, and Randall Akee, November 2020.	20-41	“Business-Level Expectations and Uncertainty,” by Nicholas Bloom, Steven J. Davis, Lucia Foster, Brian Lucking, Scott Ohlmacher, and Itay Saporta-Eksten, December 2020.
20-36	“The Grandkids Aren’t Alright: The Intergenerational Effects of Prenatal Pollution Exposure,” by Jonathan Colmer and John Voorheis, November 2020.	20-42	“Family Formation and the Great Recession,” by Garrett Anstreicher, December 2020.
20-37	“Twisting the Demand Curve: Digitalization and the Older Workforce,” by Erling Barth, James C. Davis, Richard B. Freeman, and Kristina McElheran, November 2020.	20-43	“The Shifting of the Property Tax on Urban Renters: Evidence From New York State’s Homestead Tax Option,” by David J. Scwegman and John Yinger, December 2020.
20-38	“Business Dynamics on American Indian Reservations: Evidence From Longitudinal Datasets,” by Randall Akee, Elton Mykerezzi, and Richard Todd, December 2020.	20-44	“Immigration and Entrepreneurship in the United States,” by Pierre Azoulay, Benjamin F. Jones, J. Daniel Kim, and Javier Miranda, December 2020.
20-39	“The Children of HOPE VI Demolitions: National Evidence on Labor Market Outcomes,” by John C. Haltiwanger, Mark J. Kutzbach, Giordano Palloni, Henry O. Pollakowski, Matthew Staiger, and Daniel H. Weinberg, December 2020.	20-45	“Entrepreneurial Teams: Diversity of Skills and Early-Stage Growth,” by Francesco D’Acunzio, Geoffrey Tate, and Liu Yang, December 2020.

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Appendix 5.

LONGITUDINAL EMPLOYER-HOUSEHOLD DYNAMICS (LEHD) PARTNERS

Under the Local Employment Dynamics (LED) Partnership, the Longitudinal Employer-Household Dynamics (LEHD) research team at the Center for Economic Studies produces new, cost effective, public-use information combining federal, state, and U.S. Census Bureau data on employers and employees. The LED Partnership works to fill critical data gaps and provide indicators increasingly needed by state and local authorities to make informed decisions affecting their economies and workforces.

LOCAL EMPLOYMENT DYNAMICS (LED) STEERING COMMITTEE

As of January 2021.

New England (*Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont*)
Patrick Flaherty, Director
Office of Research and Information
Connecticut Department of Labor

New York/New Jersey (*New York, New Jersey, Puerto Rico, U.S. Virgin Islands*)
Leonard Preston, Chief
Labor Market Information
New Jersey Department of Labor and Workforce Development

Mid-Atlantic (*Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, West Virginia*)
Tim Kestner, Director
Economic Information and Analytics Division
Virginia Employment Commission

Southeast (*Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee*)
Meihui Bodane, Interim Assistant Secretary of Policy, Research and Strategy
Labor and Economic Analysis Division
North Carolina Department of Commerce

Midwest (*Illinois, Indiana, Iowa, Michigan, Minnesota, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin*)
Coretta Pettway, Chief
Labor Market Information Bureau
Ohio Department of Job and Family Services

Mountain-Plains (*Colorado, Kansas, Missouri, Utah, Wyoming*)
Jeffrey Drake, Labor Market Information Manager
Missouri Economic Research and Information Center
Missouri Department of Higher Education and Workforce

Southwest (*Arkansas, Louisiana, New Mexico, Oklahoma, Texas*)
Rachel Moskowitz, Chief
Economic Research and Analysis Bureau
New Mexico Department of Workforce Solutions

Western (*Alaska, Arizona, California, Guam, Hawaii, Idaho, Nevada, Oregon, Washington*)
Robert Uhlenkott, Division Director
Workforce and Economic Research
Oregon Employment Department

FEDERAL PARTNERS

U.S. Department of Agriculture
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Hurricane Center
U.S. Department of Homeland Security, Federal Emergency Management Agency
U.S. Department of the Interior
U.S. Office of Personnel Management
U.S. Bureau of Labor Statistics
U.S. Geological Survey, Geospatial Multi-Agency Coordination
Internal Revenue Service
U.S. Army

STATE EDUCATION PARTNERS

As of January 2021.

University of Texas System
Colorado Department of Higher Education
Institute for Research on Innovation and Science,
in partnership with:
University of Michigan
University of Wisconsin—Madison
City University of New York
State University of New York
Texas Higher Education Coordinating Board
Pennsylvania State University
Connecticut State Colleges and Universities
Ohio Department of Higher Education
Indiana Commission for Higher Education
Maine Community College System
Arizona Board of Regents
Louisiana Board of Regents
University of Alabama System

STATE PARTNERS

As of January 2021.

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Labor Market Information Division
Alabama Department of Labor

Alaska

Dan Robinson, Director
Research and Analysis Section
Alaska Department of Labor and Workforce
Development

Arizona

Doug Walls, Labor Market Information Director
Arizona Office of Economic Opportunity

Arkansas

Robert S. Marek, Chief
Labor Market Information and Employer Tax
Credits Division
Arkansas Division of Workforce Services

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Amy Faulkner, Chief
Labor Market Information Division
California Employment Development Department

Colorado

Michelle Morelli, Director
Office of Labor Market Information
Colorado Department of Labor and Employment

Connecticut

Patrick Flaherty, Director
Office of Research
Connecticut Department of Labor

Delaware

Thomas Dougherty, Chief
Office of Occupational and Labor Market
Information
Delaware Department of Labor

District of Columbia

Jonathan Toye, Interim Director
Office of Labor Market Research and Performance
District of Columbia Department of Employment
Services

Florida

Adrienne Johnston, Chief
Bureau of Workforce Statistics and Economic
Research
Florida Department of Economic Opportunity

Georgia

Mark Watson, Director
Workforce Statistics and Economic Research
Georgia Department of Labor

Guam

Gary Hiles, Chief Economist
Government of Guam
Department of Labor

Hawaii

Jeri Sato, Acting Co-Director
Jeri Arucan, Acting Co-Director
Research and Statistics Office
Hawaii Department of Labor and Industrial
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Idaho

Salvador Vazquez, Labor Market Information
Director
Research and Analysis Bureau
Idaho Department of Labor

Illinois

Kristin Richards, Director
Economic Information and Analysis Division
Illinois Department of Employment Security

Indiana

Charlie Baer, LMI Director
Research and Analysis
Indiana Department of Workforce Development

Iowa

Christina Steen, Director
Labor Market Information Division
Iowa Workforce Development

Kansas

Angela Berland, Director
Labor Market Information Services
Kansas Department of Labor

Kentucky

Jessica Cunningham, Interim Executive Director
Kentucky Center for Statistics

Louisiana

Mark Jones, Research and Statistics Director
Office of Occupational Information Services
Louisiana Workforce Commission

Maine

Mark McNerney, Director
Center for Workforce Research and Information
Maine Department of Labor

Maryland

Carolyn Mitchell, Director
Office of Workforce Information and Performance
Maryland Department of Labor

Massachusetts

Ron Maranian, Acting Director
Economic Research Department
Massachusetts Department of Unemployment
Assistance

Michigan

Scott Powell, Director
Bureau of Labor Market Information and
Strategic Initiatives
Michigan Department of Technology, Management,
and Budget

Minnesota

Oriane Casale, Acting Director
BLS Cooperative Programs
Minnesota Department of Employment and
Economic Development

Mississippi

Mary Willoughby, Bureau Director
Labor Market Information
Mississippi Department of Employment Security

Missouri

Jeffrey Drake, Labor Market Information Manager
Missouri Economic Research and Information
Center
Missouri Department of Higher Education and
Workforce Development

Montana

Mike Peery, Director
Labor Market Information
Montana Department of Labor and Industry

Nebraska

Scott Hunzeker, Research Administrator
Nebraska Department of Labor

Nevada

David Schmidt, Chief Economist
Research and Analysis Bureau
Nevada Department of Employment, Training,
and Rehabilitation

New Hampshire

Brian Gottlob, Director
Economic and Labor Market Information Bureau
New Hampshire Department of Employment
Security

New Jersey

Chester Chinsky, Director
Economic and Demographic Research
New Jersey Department of Labor and Workforce
Development

New Mexico

Rachel Moskowitz, Chief
Economic Research and Analysis Bureau
New Mexico Department of Workforce Solutions

New York

Odo Butler, Director
Division of Research and Statistics
New York State Department of Labor

North Carolina

Meihui Bodane, Interim Assistant Secretary of
Policy, Research, and Strategy
Labor and Economic Analysis Division
North Carolina Department of Commerce

North Dakota

Marcia Havens, Manager
Labor Market Information Center
Job Service North Dakota

Ohio

Coretta Pettway, Chief
Labor Market Information Bureau
Ohio Department of Job and Family Services

Oklahoma

Lynn Gray, Director
Economic Research and Analysis
Oklahoma Employment Security Commission

Oregon

Robert Uhlenkott, Division Director
Workforce and Economic Research
Oregon Employment Department

Pennsylvania

Ed Legge, Director
Center for Workforce Information and Analysis
Pennsylvania Department of Labor and Industry

Puerto Rico

Juan Lopez, Acting Director
Bureau of Labor Statistics
Department of Labor

Rhode Island

Donna Murray, Assistant Director
Labor Market Information
Rhode Island Department of Labor and Training

South Carolina

Brian Nottingham, Director
Business Intelligence Department
South Carolina Department of Employment
and Workforce

South Dakota

Melodee Lane, Administrator
Labor Market Information Center
South Dakota Department of Labor and Regulation

Tennessee

Kshitiz Rastogi, Director
Workforce Insights and Reporting Engine Division
Tennessee Department of Labor and Workforce
Development

Texas

Mariana Vega, Director
Labor Market Information
Texas Workforce Commission

Utah

Collin Petersen, Director
Research and Analysis
Utah Department of Workforce Services

Vermont

Mathew Barewicz, Director
Economic and Labor Market Information Section
Vermont Department of Labor

Virgin Islands

Gary Halyard, Director
Bureau of Labor Statistics
U.S. Virgin Islands Department of Labor

Virginia

Tim Kestner, Director
Economic Information and Analytics Division
Virginia Employment Commission

Washington

Steven Ross, Director
Labor Market and Economic Analysis
Washington Employment Security Department

West Virginia

Joseph Jarvis, Director
Research, Information and Analysis Division
Workforce West Virginia

Wisconsin

Dennis Winters, Director
Bureau of Workforce Information and Technical
Support
Wisconsin Department of Workforce Development

Wyoming

Tony Glover, Manager
Research and Planning
Wyoming Department of Workforce Services

Appendix 6.

CENTER FOR ECONOMIC STUDIES ORGANIZATIONAL CHART (January 2021)

